Twin Creek Wind Farm
RES Australia Pty Ltd
26-Jun-2017

Traffic Impact Assessment

for DA Submission

Traffic Impact Assessment

for DA Submission

Client: RES Australia Pty Ltd

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A	13-Oct-2016	Draft for RES review	Kylie Schmidt Project Manager	
B	21-Mar-2017	Final Report	Kylie Schmidt Project Manager	
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Vehicle Turn Path Drawings

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Executive Summary

AECOM Australia Pty Ltd (AECOM) has been commissioned by RES Australia Pty Limited (RES) to provide a Traffic Impact Assessment (TIA) for the proposed Twin Creek Wind Farm, which includes up to 51 wind turbine generators with a total installed wind capacity of up to 183 MW and associated infrastructure. This impact assessment forms parts of the development application for the wind farm and details the impacts of the transport related activities associated with the life cycle of the wind farm development through construction, operation and decommissioning phases.

The proposed site is located approximately 90 km north of Adelaide, near the townships of Kapunda, Koonunga, Truro and Eudunda, on land that is currently used for grazing (sheep) and cropping by private landowners. The surrounding arterial road network is primarily state-managed, high speed rural arterial roads, with Thiele Highway and Sturt Highway having relatively high daily traffic volumes in comparison to the surrounding network. Minor roads in the area are primarily unsealed roads. Currently, Thiele Highway, Sturt Highway and Truro Road are approved for restricted access vehicles up to PBS Class 2A, such as a 26 m B-double.

Throughout the life of the wind farm, access is required by both general and restricted access vehicles. It is expected that the highest volume of traffic will be experienced during the construction phase, where turbine components and construction materials will need to be transported to the site. It is assumed that the majority of construction materials and employees will access the site using general access vehicles, and so can use roads on the surrounding network.

The turbine components will require vehicles to move either over dimensional or over mass (or both) loads so an approved access route to be established. The preferred route for these components is likely to be from the Port of Adelaide and therefore require transportation through the metropolitan region to the site via the arterial road network. The preferred access route is Port of Adelaide, via Port River Expressway, Port Wakefield Road, the Northern Expressway, Sturt Highway, Truro Road, Bagot Well Road, Camel Hill Road, Flagstaff Hill Road and Mosey Road to the site access point.

The construction phase of the wind farm is expected to create the greatest traffic generated by the development over an assumed 18 month period. Overall, it is estimated that there will be 175,000 one-way vehicle trips, comprised of:

- 1,500 over dimensional and over mass trips
- 32,000 truck trips
- 53,000 car trips

This relates to an approximate daily volume of 7 over dimensional or over mass vehicles, 60 heavy vehicles and 140 car trips.

The traffic impact results in less than 10% increase in traffic volumes on most arterial roads surrounding the site as they already experience relatively high volumes of traffic. The most significant increases are expected to be on Truro Road. The expected impact on minor unsealed roads along the preferred route is assumed be significant, as they are currently used for access to adjacent properties.

As a large proportion of the traffic generated during the construction phase is temporarily either over dimensional, over mass loads (or both), consideration must be given to the suitability of the road infrastructure and vertical envelope restrictions for the route. Permits must be sought for these movements to occur.

In general, the road network is considered adequate for the transportation of over dimensional loads. Structural assessments will need to be carried out for over mass vehicles, particularly over the bridge located on Truro Road.

Some tree pruning, modifications and access to private land will be required for the movement of over dimensional trucks to the site, particularly from the intersection of Sturt Highway and Truro Road, through to the site entrance on Mosey Road. This is to allow for the over height dimensions of some components and improve safe turning access.

Noise and dust may be generated by the traffic impacts during the construction phase, which can be minimised using various mitigation techniques. These should be confirmed with local residents and departmental bodies during an extensive stakeholder and community engagement process.

Overall, the traffic generated by this development will have an impact on the daily traffic usage of the surrounding road network as a result of predicted construction movements, operations and maintenance work and decommissioning activities. Allowing for the implementation of mitigation measures including traffic management plans and compliance with permit conditions, the impacts from traffic and related activities are considered acceptable for the area in which the Twin Creek Wind farm is proposed.

This Traffic Impact Assessment provides guidance for assessment of the required development approval for the wind farm. A more detailed Traffic Management Plan will be developed once Development Approval is obtained.

Figure 1 Recommended route for access to the proposed Twin Creek Wind Farm site

1.0 Project Description

1.1 Introduction

RES Australia Pty Ltd (RES Australia) proposes to develop the Twin Creek Wind Farm within the Mid North area of South Australia. The site of the proposed wind farm is approximately 90km north east of Adelaide and north east of Kapunda.

RES is one of the world's leading independent renewable energy companies, with the expertise to develop, engineer, construct, finance, and operate projects around the globe. RES Australia has been developing renewable energy projects in Australia since 2004.

1.2 Project Overview

The proposed wind farm will consist of the following components:

- Up to 51 Wind Turbines Generators (WTG)
- Each WTG has a capacity up to 3.6 Megawatts (MW), with a total installed wind capacity approximately 185MW
- Overall height of turbines would be up to 180 metres at the blade tip
- Associated hard standing areas and access roads
- Operations and maintenance building and compound with associated car parking
- Two electrical substations
- 50MW battery energy storage facility
- Overhead and underground electrical cable reticulation
- Overhead transmission line for approximately 15 kilometres from the on-site substation to the existing overhead Robertstown - Tungkillo transmission line east of Truro
- Meteorological masts for measuring wind speed and other climatic conditions
- Temporary construction facilities including a borrow pit and concrete batching plant facilities.

2.0 Project Siting/Locality Description

RES Australia proposes to develop the Twin Creek Wind Farm within the Mid North area of South Australia. The site of the proposed wind farm is approximately 90km north east of Adelaide and 11km north east of Kapunda. The proposed development is located between the townships of Kapunda, Eudunda and Truro.

The site is located on the tablelands that form the wide ridgeline associated with Bald Hill and Long Hill situated within the Northern Mount Lofty Ranges.

Landform of the area is defined by numerous ridgelines that run north-south through the site creating a series of parallel ridges, wide open valleys, tablelands and isolated topographic features.

Surrounding the site of the proposed development, the landscape is dominated by grazing with open paddocks defined by fenced boundaries and occasional trees to fence lines and creek lines. The land use that occurs in the open valley floor between the local ridgelines and across the tablelands associated with Bald Hill is more diverse with areas of arable cropping and grazing.

3.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been commissioned by RES Australia Pty Limited (RES) to provide a Traffic Impact Assessment (TIA) for the proposed Twin Creek Wind Farm.

This TIA supports the Development Application for the Twin Creek Wind Farm and details the impacts of the transport related activities associated with the life cycle of the wind farm development through construction, operation and decommissioning phases.

Each phase of the wind farm life cycle will generate different traffic and access requirements which have been estimated and assessed to understand the extent of the impact on the local area and identify any potential restrictions that may need to be placed on the proposal through its phases.

The construction phase will generate the largest volumes of traffic and therefore have the greatest impact on the road network. This report assesses the identified route options with consideration for the size, weight and frequency of vehicles and their respective loads in order to identify likely requirements for infrastructure or operating restrictions that may be required for the development to proceed. A more detailed Traffic Management Plan will be completed once development approval is obtained and will include more specific on-site inspections and detailed investigations of the final routes selected. The access points will be reviewed in more detail and any mitigating measures required to enable safe and appropriate access will be detailed.

The report is structured as follows:

- An **existing conditions assessment** is conducted to identify the current land uses and traffic demands in the locality of the proposed wind farm (Section 4.0)
- **Access routes for vehicles during construction** are investigated and assessed in consultation with relevant stakeholder groups in order to minimise the impact of the delivery of wind farm components to the site (Section 5.0)
- A **Traffic Impact Assessment** is conducted to identify the traffic generated through the full life cycle of the proposed development, including construction, operation and decommissioning phases (Section 6.0)
- Access to the site is assessed to identify **key access considerations**, such as overhanging trees, low level power lines, road and pavement conditions, and potential generation of noise and dust (Section 7.0)
- The relevant **permits** required for the proposed development are identified (Section 8.0)
- All key **safety considerations** are identified and assessed in order to ensure the safe and sustainable implementation of the proposed development (Section 9.0)
- Finally **recommendations** are given in Section 10.0

Consultation completed during the TIA include Light Regional Council and Department of Planning, Transport and Infrastructure.

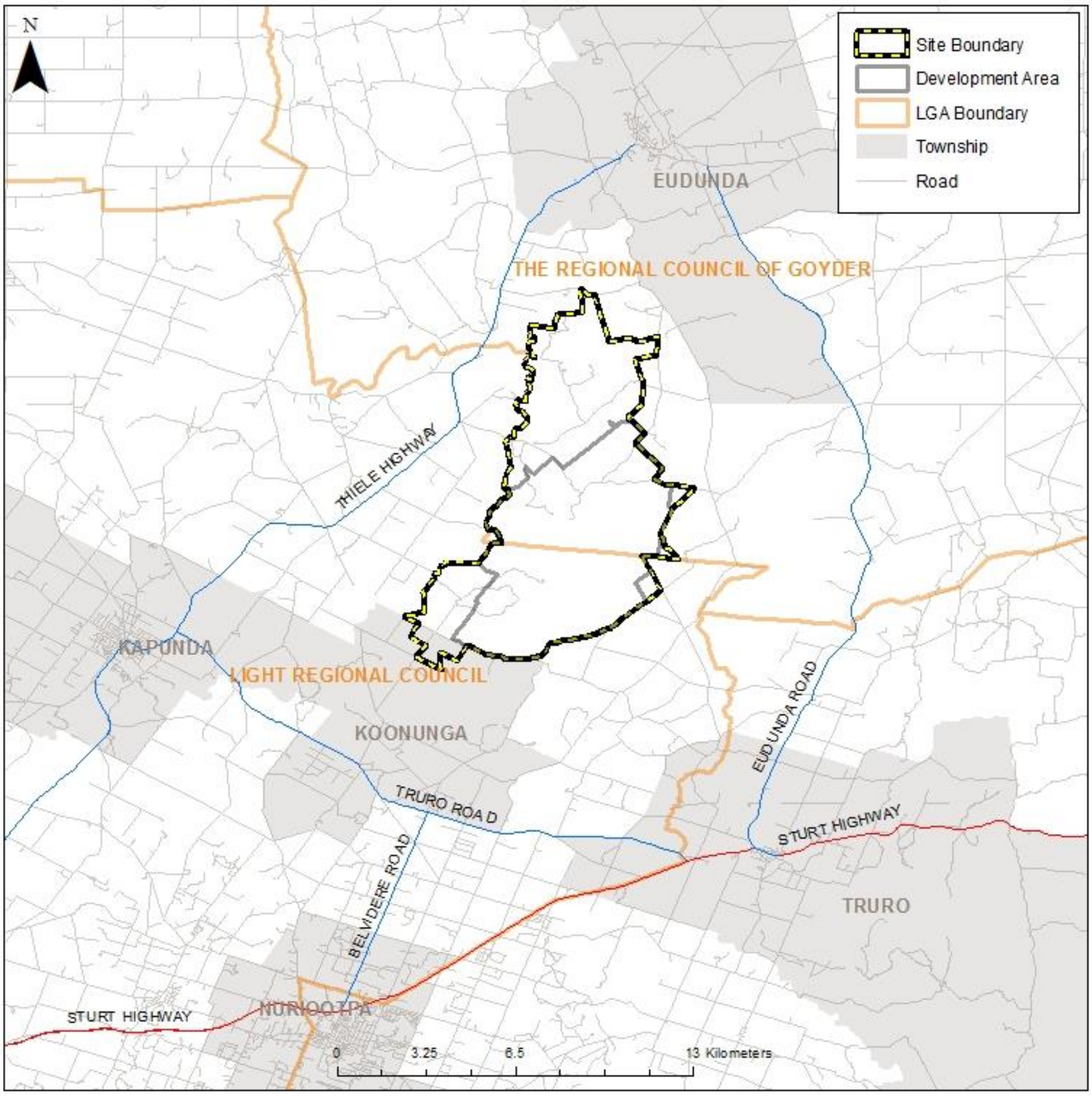
4.0 Existing Road Conditions

4.1 Location

The Twin Creek Wind Farm is proposed to be located 90 km northeast of Adelaide in South Australia's Mid-North Region near the township of Kapunda, with a 275 kV transmission line across to the terminal substation and 275 kV tee located east of the township of Truro. The site crosses two local council areas (Light Regional Council and Regional Council of Goyder) and the associated electricity sub-station in a third council area (Mid Murray Council). The typical land use in this farming area is agriculture, horticulture and livestock grazing.

The main townships in the vicinity of the proposed wind farm development are Kapunda, Truro, Eudunda and the smaller township of Koonunga. The township zoned areas are shown in Figure 2 below. Kapunda is the main town centre for the Light Regional Council and is located on the Thiele Highway approximately 77 km north of Adelaide. The Koonunga area is located southeast of Kapunda on the Truro Road. The township of Truro is located further to the east on the Sturt Highway and also connected to Kapunda via the Truro Road. The township of Eudunda is approximately 27 km northwest of Kapunda and operates as the southern town centre of the Regional Council of Goyder.

Figure 2 Location of proposed Twin Creek Wind Farm development



4.2 Surrounding Road Network

The proposed wind farm is located between the Sturt Highway (part of the National Land Transport Network) and Thiele Highway (State arterial road) on private land that is serviced by local roads (typically unsealed).

4.2.1 Arterial Road Network

The arterial roads located near the development area that will provide main preliminary access to the proposed wind farm are listed in Table 1.

Table 1 Arterial roads surrounding the development site

Arterial Road	Road Management Authority	Road Category	AADT*
Sturt Highway	DPTI	Arterial	4300 – 4200
Thiele Highway	DPTI	Arterial	1200
Truro Road	DPTI	Arterial	1200

*Department of Planning Transport and Infrastructure (2016b)

All arterial roads are two-way, sealed and marked roads with a designated speed limit of 100 km/hr for most roads with the exception of Sturt Highway (110 km/hr) and Eudunda Road from Truro to Dutton (80 km/hr). The routes are generally state-managed, with the exception of Belvidere and Eudunda Roads, which are managed by Light Regional and Goyder Councils respectively.

Average Annual Daily Traffic (AADT) estimates are provided for the state-managed arterial roads in the vicinity of the site, as shown in Figure 3. Sturt Highway has the highest daily traffic volume out of all arterial roads considered, with traffic flows of 8,500 and 4,300 along sections between Gomersal and Greenock Roads and Moppa and Truro Roads, respectively.

4.2.2 Collector Roads/Key Local Roads

While local roads typically carry less volume of traffic than arterial roads, Table 2 lists two significant regional collector roads that service the area.

Table 2 Local collector roads

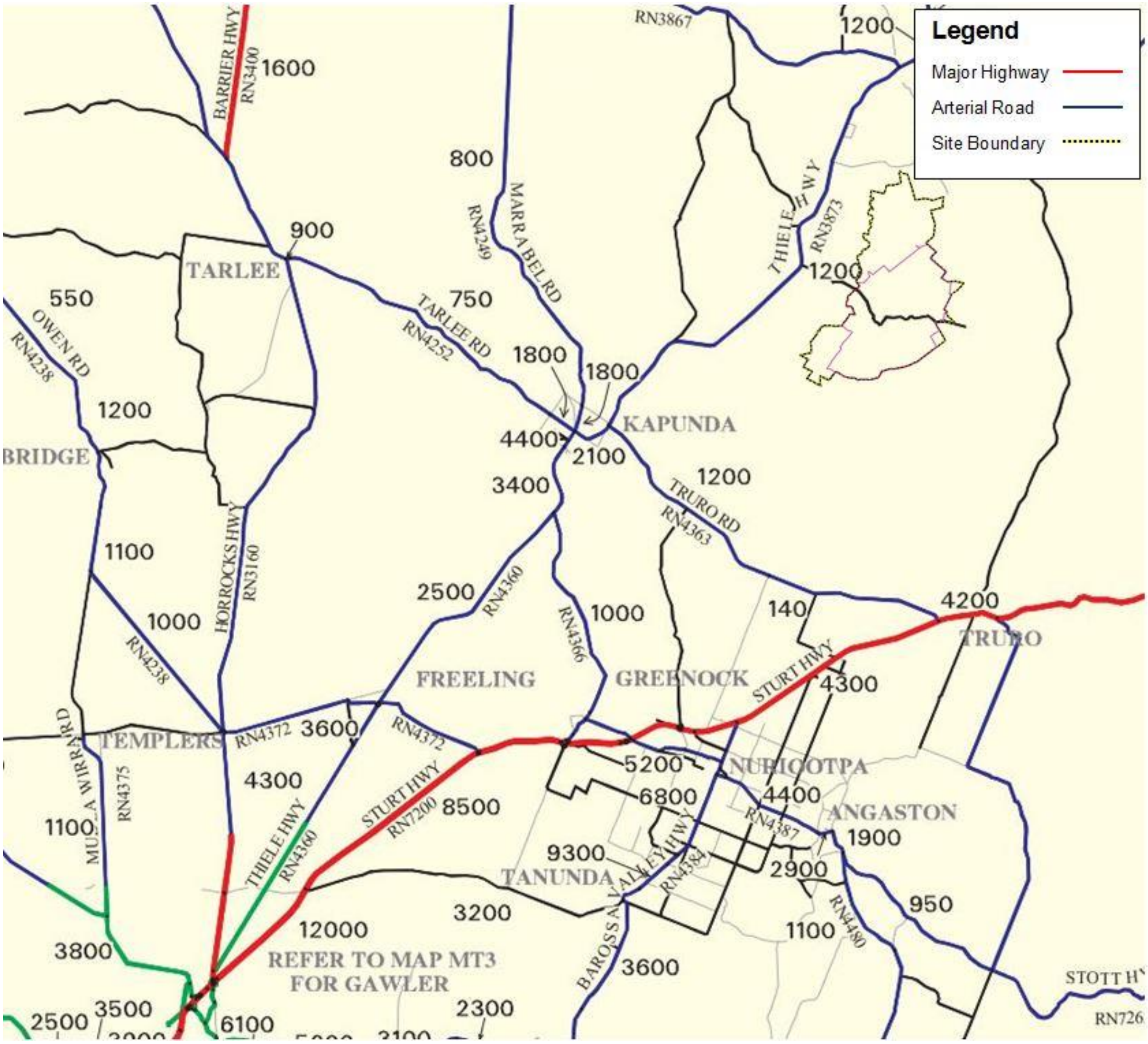
Collector Road	Road Management Authority	Road Category	AADT*
Eudunda Road	Regional Council of Goyder	Regional Collector Road	Not available
Belvidere Road	Light Regional Council	Regional Collector Road	Not available

4.2.3 Other Local Roads

The area proposed for the wind farm, and typical of the Mid North Region, has a local road network mostly consisting on unsealed, low trafficked roads providing access to farms and residential properties scattered through the region. The majority are all weather roads however some may be less suitable to carrying heavy loads during winter months when rainfall can make the unsealed roads of poorer construction quality unsuitable for use. Many of the local roads cross the path of the Light River and branches of that water course. These crossing points are a combination of bridge structures, culverts and causeways. The site is bounded and intersected by the following local roads;

- Flagstaff Hill Road
- Mosey Road
- Camel Farm Road
- Weaver Road
- Noack Road
- Leakes Pass
- Holding Road
- Travers Road
- Teagle Road
- Ben Lomond Road
- Bagot Well Road

Figure 3 **Annual Average Daily Traffic Estimate 24 hour two way flows (Department of Planning, Transport and Infrastructure 2016b)**



4.2.4 Approved Heavy Vehicle Routes

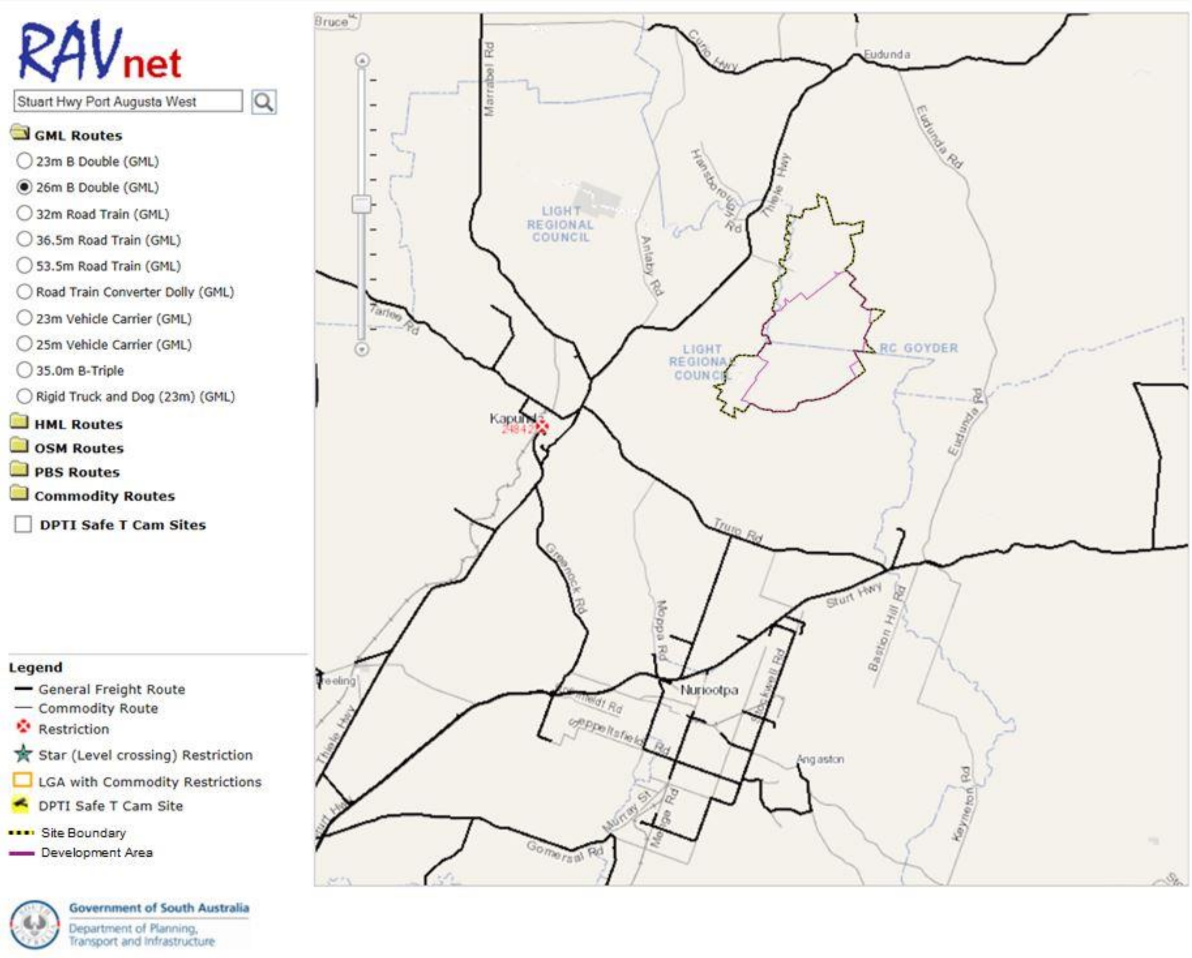
The Performance Based Standards (PBS) scheme provides the operating environment for the vehicles that fit within the specified PBS categories. In turn they provide limits and restrictions for the categories of vehicles on the road network as a way of maintaining safety, vehicle productivity and infrastructure quality standards. The performance levels are classified according to vehicle length, as shown in Table 3 and RAVnet, accessed via the DPTI website (2016a), identifies the approved routes for each class.

Figure 4 below indicates the access routes for the PBS category of Level 2B vehicles, such as 26m B-double configurations which would be the largest of the type of vehicle used for many of the construction activities (with the exception of the over-dimensional loads transporting the wind turbine components). It should be noted that Eudunda Road is the only road that is not classified as PBS approved route.

Table 3 PBS route network classification (Department for Transport, Energy and Infrastructure 2011)

Vehicle Performance Level	Network Access by Vehicle Length (m)	
	Access Class A	Access Class B
Level 1	L ≤ 20	
Level 2	L ≤ 26	26 < L ≤ 36.5
Level 3	L ≤ 36.5	36.5 < L ≤ 42
Level 4	L ≤ 53.5	53.5 < L ≤ 60

Figure 4 Approved restricted access vehicle routes approved under PBS Level 2A – 26m B-double (Department of Planning, Transport and Infrastructure 2016a)



4.3 Public transport

There are limited public transport services provided in the area. School bus services are provided for a number of schools, such as Kapunda High School, Kapunda Primary School, Eudunda Area School and St John's Lutheran School operate in the area of the proposed wind farm site. These school buses typically operate Monday to Friday between 8am – 9am and 3pm to 4pm. Their specific routes and timetables change each year depending on the location of the students who use the service.

5.0 Access Routes for Vehicles during Construction

Vehicles used to transport materials and components to the proposed site during construction are likely to originate from the following locations once in South Australia.

Table 4 Origin of construction materials and components

Material/ Component	Description	Likely origin of associated transport to site	Refer to section
Large turbine components	Blades (up to 67m in length) Narcelle (single unit) Tower (sections) Hub (single unit) Sub-station components	Port Adelaide Port Pirie	Over-dimensional 5.1
Locally manufactured or sourced components	Various	Greater Metropolitan Adelaide	5.2 and 5.3
Construction materials	Steel reinforcing, concrete, quarry material	Greater Adelaide and Local Region	5.2 and 5.3
Labour	Staff, contractors	Adelaide and Local Region	5.3

In general, the turbine components are indivisible and due to their size and weight they fall into the over dimensional and/or over mass category for access on the road network. Over dimensional and over mass vehicles and their loads require specific permits to access and move along the public road network. Due to their size and physical characteristics, their movement is restricted to specific routes.

Locally manufactured and sourced components and construction materials are likely to be transported to the site in general access vehicles and can therefore use most of the surrounding road network to access the proposed site however a preferred route has been identified to minimise the impact of the traffic movements on the local area.

Table 5 Maximum limits for general access (Department for Transport, Energy and Infrastructure 2011)

Dimension	Maximum Limit	Units
Gross Mass	42.5	tonne
Width	2.5	metre
Height	4.3	metre
Length	19.0	metre

Labour associated with the construction of the proposed wind farm are likely to arrive on site via passenger vehicle or 4WD vehicles.

In order to determine a preferred access route for construction vehicles, the following factors must be considered:

- The required Performance Based Standards (PBS) level for the transportation of each over-dimensional and over mass component and the type of vehicle used to transport the component
- The delivery of materials with regard to surrounding quarry locations
- Suitability of preferred route for all weather access and structural capacity of the road infrastructure (pavement and bridge/culverts)
- Limitations of existing road network (vertical and horizontal clearance envelopes)
- The general impact on road users and the community must be considered

5.1 Over-dimensional and Over-mass Requirements for Construction

5.1.1 Types of Over-dimensional and Over-mass Loads

A major aspect of the transport requirements of the construction phase for the wind farm is the movement of the wind turbine components. The wind turbines proposed to be used for the development are Vestas 136 with a height (at the blade tip) of 180 m from ground level. The other large over-dimensional/ over-mass loads are associated with the wind farm substation and the terminal substation located at the 275kV tee in located on land adjacent to the Sturt Highway near the township of Truro.

Assessment of the impacts of transport of the components for the proposed turbines has been based on the Vestas 136 model and is specific to its dimensional specifications. These turbines are comprised of 3 blades, 1 nacelle, 5 tower sections, and 1 turbine hub as shown in Figure 5 below. Each component will require transportation to the site individually. The dimensions of these components are shown in Table 6 below.

Figure 5 Typical wind turbine structure

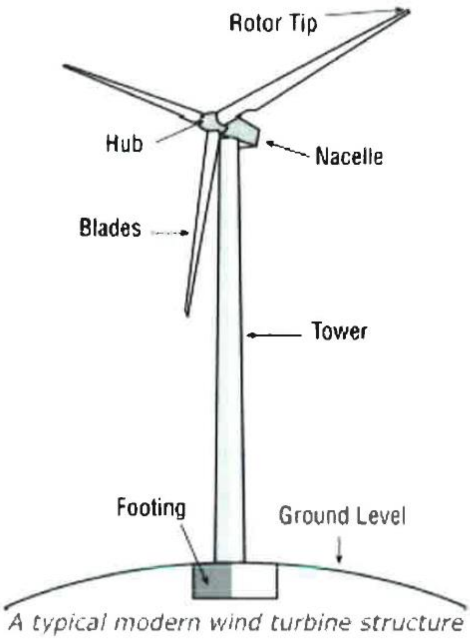


Table 6 Approximate weight and height dimensions of the wind turbine components (Vestas Wind System A/S 2016)

Component	Height (m)	Length (m)	Width (m)	Weight (Tonnes)	Over Dimensional	Over Mass	Suitable PBS Level Access
Nacelle	3.4	12.8	4.2	70	Y (due to height and width)	Y	1A: single articulated vehicle of truck trailer combination
Hub	3.8	3.8	5.5	70	Y (due to height and width)	Y	1A: single articulated vehicle of truck trailer combination
Blades	4.1	66.7	-	5.5 – 6.5	Y	N	Exceeds PBS level 4 due to length

Table 7 Approximate weight and dimensions of the tower components (Vestas Wind System A/S 2016)

Component	Min Diameter (m)	Max Diameter (m)	Length (m)	Weight (Tonnes)	Over Dimensional	Over Mass	Suitable PBS Level vehicle
1 (Top)	2.0 – 2.5	3.0 – 3.5	20.0 – 25.0	25.0	Y	N	2A: B-double
2 (Middle)	3.0 – 3.5	3.5 – 4.0	20.0 – 25.0	40.0	Y	N	2A: B-double
3 (Middle)	3.0 – 3.5	3.5 – 4.0	20.0 – 25.0	40.0	Y	N	2A: B-double
4 (Middle)	3.0 – 3.5	3.5 – 4.0	20.0 – 25.0	40.0	Y	N	2A: B-double
5 (Bottom)	3.5 – 4.0	4.5 – 5.0	20.0 – 25.0	35.0	Y	N	2A: B-double

Table 7 does not recommend the type of vehicle to use for each component. Its purpose is to demonstrate the smallest vehicle (in PBS class) that may be used to transport the component and therefore the route along which that vehicle may travel. This assists in identifying appropriate transport routes to the proposed site.

It should be noted that all wind turbine and tower components fall into the over dimensional category and will therefore require individual permits and police escorts for transportation to the site. It is likely that specific vehicle configurations will be adopted to best suit the load and route selected to access the proposed site.

The nacelle and the hub components fall into the over mass category and therefore also require a permit to be transported. Where these components are being transported along a route with bridge or culvert structures and poorly constructed unsealed roads, a structural assessment of the bridge or culvert load capacity should be undertaken of the selected route during development of the Traffic Management Plan.

In order to connect the wind farm to the grid, two substations will be constructed. One substation will be located on the south-eastern side of the wind farm site near the wind farm access point, as shown in Figure 6 . The terminal substation is to be located adjacent the Sturt Highway near the township of Truro at the 275 kV tee in point, also shown in Figure 6. The substation components are both over dimensional and over mass, requiring permits to be transported to the site.

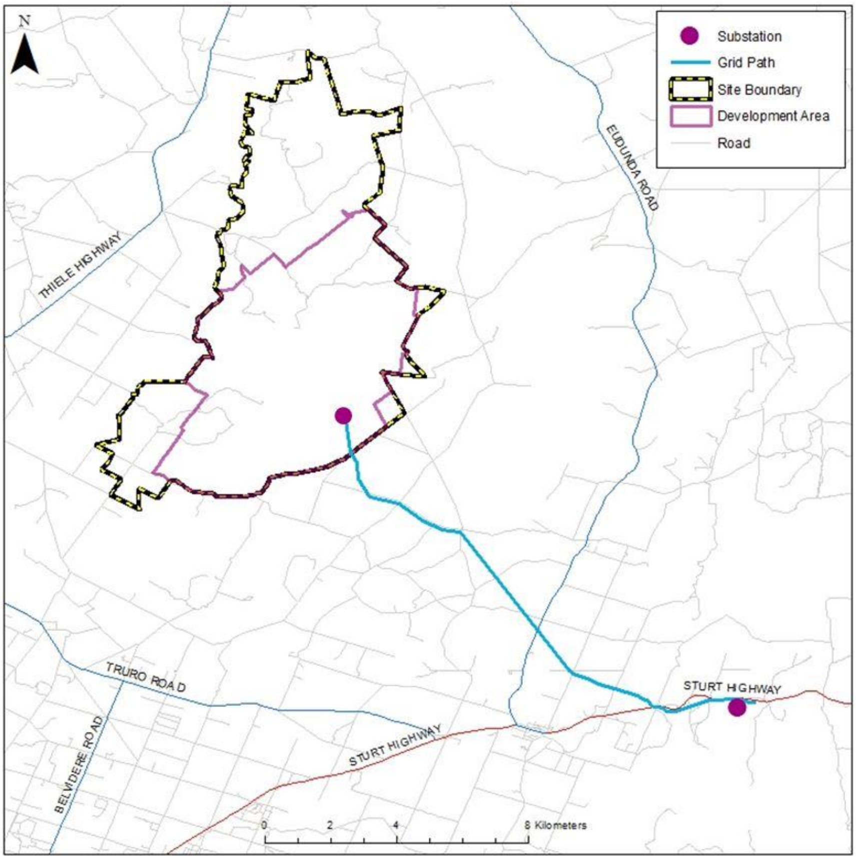
Other infrastructure associated with the wind farm and substation include transportable buildings and potential battery storage components. These components may fall into the over-dimensional category for transportation and therefore require appropriate permits.

It is likely that the wind turbine, tower components and substation components will need to be transported from either Port of Adelaide or from Port Pirie, being the two closest sea ports to the site (Port Pirie, located on the east coast of the Spencer Gulf, and Port Adelaide, located 14 kilometres northwest of the Adelaide CBD). Access from these ports can be problematic for over-dimensional loads, particularly 67m long blades. This report has assessed the potential access routes from the ports and identified the most feasible routes and identified the possible constraints on these routes. From either port, the routes along Port Wakefield Road and the Sturt Highway offer the most suitable for transport of over-dimensional loads for the majority of the transport journey. These options are discussed in more detail below.

Table 8 Approximate weight and dimensions of substation transformer component

Component	Height (m)	Length (m)	Width (m)	Weight (Tonnes)	Over Dimensional	Over Mass
Transformer 275/33kV	7.0	8.0	8.0	145.7	Y	Y
Transformer 275/275 kV	7.5	9.0	5.5	TBC Slightly greater than 145.7t	Y	Y

Figure 6 Location of substation facility on site and adjacent the Sturt Highway



5.1.2 Proposed Routes for Transport of Over-dimensional/Over-mass Components

The majority of the transport route to the proposed wind farm site will be via the Sturt Highway which is suitable for movement of over-dimensional loads under permit. There are two options available to access the Sturt Highway from the port including,

Option A – Port of Adelaide to Sturt Highway, and

Option B – Port Pirie to Sturt Highway

Once the components have been transported along the Sturt Highway, there are two local road options to access the wind farm site. These are;

Option 1 – via Bagot Well Road

Option 2 – via Teagle Road

Both of these options access the Wind Farm site via Mosey Road.

5.1.3 Option A - Transport from Port of Adelaide

Figure 8 shows the possible access route to the site if the turbine components are sourced from Port Adelaide. The site can be accessed from the Port of Adelaide via;

- Ocean Steamers Road,
- Eastern Parade,
- Port River Expressway/Salisbury Highway,
- Port Wakefield Road,
- Northern Expressway,
- Sturt Highway,

- Truro Road

The route above has previously been approved by DPTI (Over Dimensional Permit Section) for wind farm blade and prime mover total length of 65.00 m. The proposed V136 turbines have 66.7 m blades and therefore turning constraints may exist along the route. The most likely locations that may cause concern have been checked for turning path movement of the longer blade length (ref Appendix B). These locations are;

- Ocean Steamers Road / Eastern Parade intersection,
- Eastern Parade / Port River Expressway
- Sturt Highway / Truro Road,
- Truro Road / Bagot Well Road

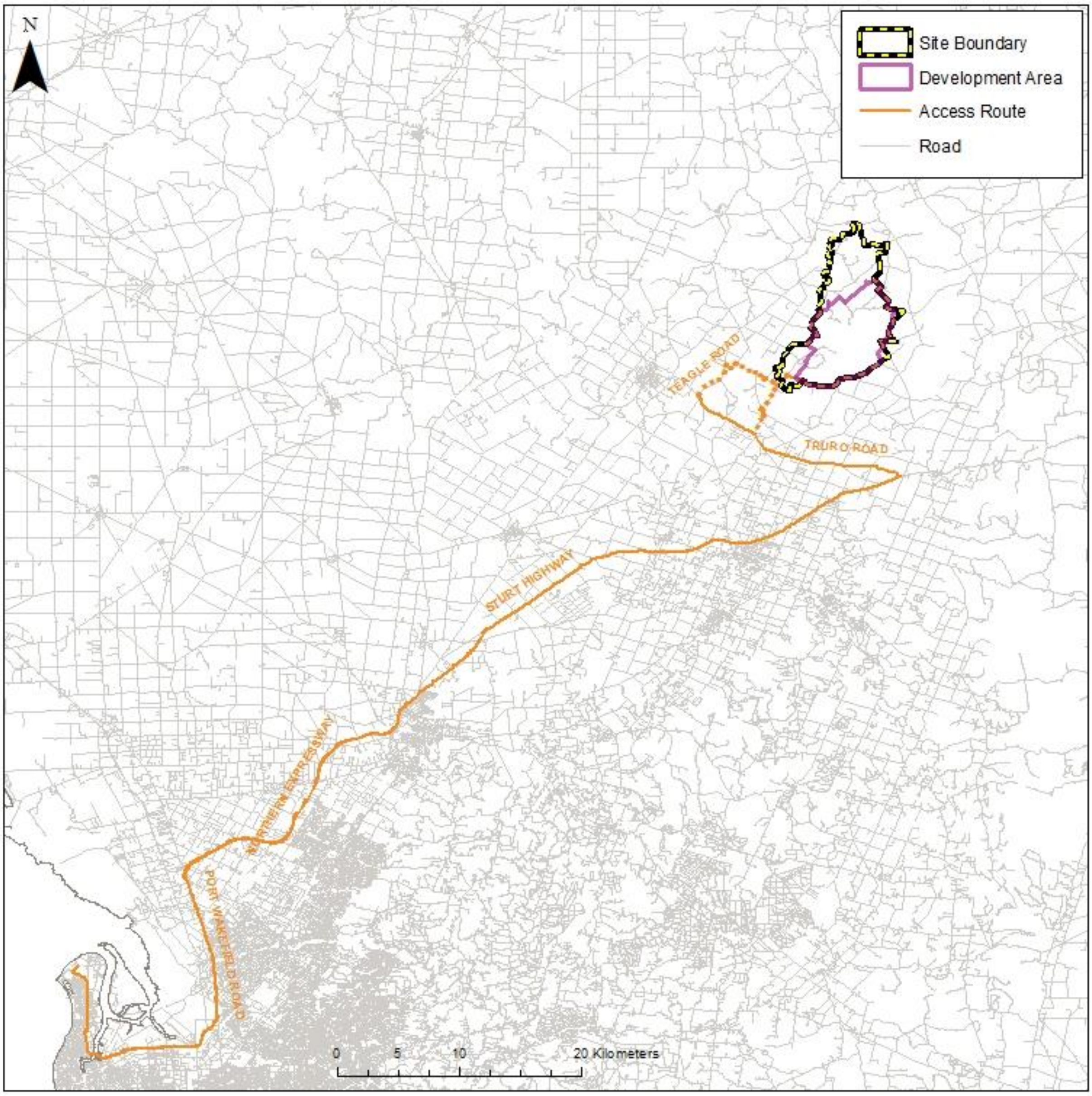
The turning path checks undertaken at these locations have indicated some minor alterations are required to enable passage of the 66.7m blades though these locations depending on the direction of travel.

It should be noted that at the Port of Adelaide, a storage location for wind turbine components is currently being utilised as shown in Figure 7. The location of this storage yard removes any turning constraints at the intersection of Ocean Steamers Road / Eastern Parade intersection.

Figure 7 Port of Adelaide storage of wind turbine components in proximity to Ocean Steamers Road / Eastern Parade

Depending on the origin of the substation components, this route is likely to be considered appropriate for movement of those items. A more detailed assessment of this route will be required during the development of the Traffic Management Plan once development approval is achieved.

Figure 8 Option A - Access route from Port of Adelaide

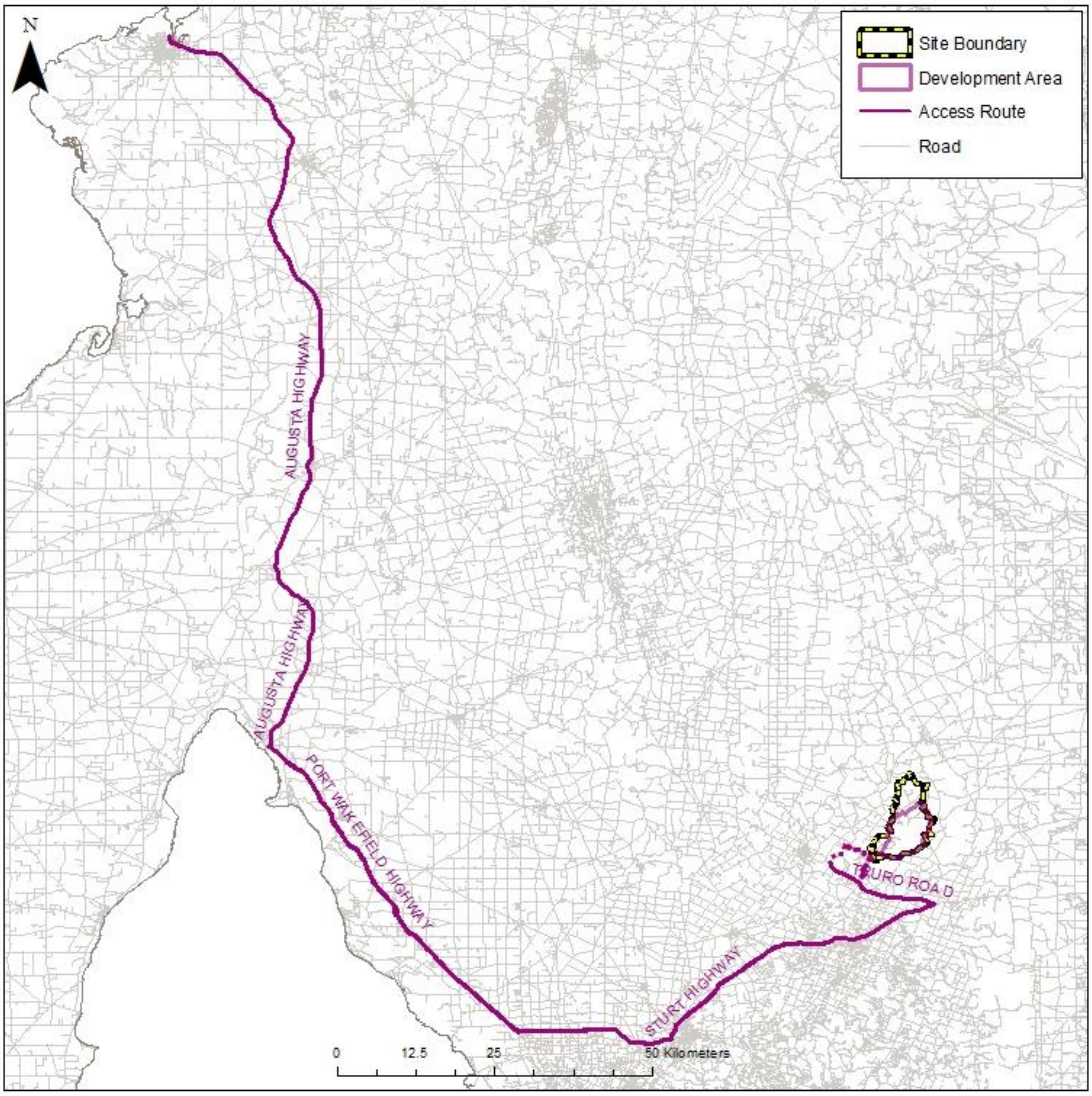


5.1.4 Option B - Transport from Port Pirie

Figure 9 shows the alternative access route to the site if the turbine components originate from Port Pirie. This route is described as;

- Ellen Street / Main Road / Warnertown Road,
- Augusta Highway / Princes Highway,
- Port Wakefield Road,
- Gawler Road / Two Wells Road,
- Northern Expressway,
- Sturt Highway,
- Truro Road.

Figure 9 Option B - Access route from Port Pirie



Part of the route above has been previously been approved by DPTI (Over Dimensional Permit Section) for wind farm blades associated with wind farms on the Yorke Peninsula. The Twin Creek wind farm proposal uses 66.7m blades and therefore turning constraints may exist along the route. The most likely locations that may cause concern have been checked for turning path movement of the longer blade length (ref Appendix B). These locations are;

- Ellen Street / Main Road,
- Port Wakefield Road / Gawler Road,
- Sturt Highway / Truro Road
- Truro Road / Bagot Well Road (as per Option A)

The turning path checks undertaken at these locations have indicated some minor alterations are required to enable passage of the 66.7m blades though these locations depending on the direction of travel.

Depending on the origin of the substation components, this route is likely to be considered appropriate for movement of those items. A more detailed assessment of this route will be required during the development of the Traffic Management Plan once development approval is achieved.

5.2 Restricted Access Vehicle Requirements for Construction Phase

Should the construction phase of the wind farm require the use of Restricted Access Vehicles (RAV's), consideration will need to be given to the type of vehicle to be used. RAV vehicles are those that are larger than the parameters of General Access Vehicles that can generally travel anywhere on the road network. RAV's operate under permit on gazetted routes defined under the national Performance Based Standards (PBS) scheme. The vehicles typically used in this category are 23m and 26m B-double vehicles.

The greatest volume of restricted access vehicle use is likely to be during the construction phase for the delivery of miscellaneous construction equipment and materials however much of this may also be via General Access Vehicles (semi-trailer or smaller).

The routes identified in Section 5.1 above are suitable for vehicles up to and including 26m B-Doubles to Truro Road. Access from Truro Road to the Wind Farm site for vehicles of this size would need to be the subject of more detailed assessment and permits obtained as required.

5.3 General Access Vehicle Requirements for Construction Phase

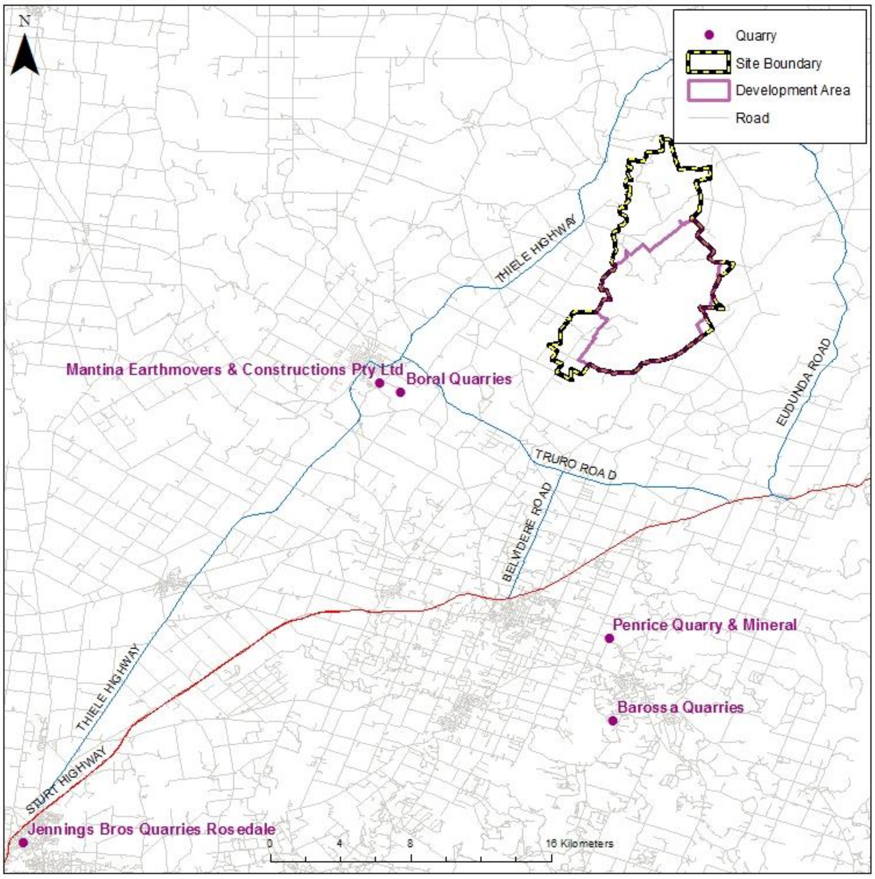
It is assumed that the majority of other construction materials and smaller sized components required in building the wind farm, substations and associated infrastructure can be transported to the site in semi-trailers.

A significant number of trips will be generated of general access vehicles to the site and this is discussed in more detail in the following section. The origin of these vehicle movements can be quite diverse as indicated in Table 4 above.

While transport of staff and labour for the project may originate from Greater Metropolitan Adelaide and broader in the Mid North Region, quarry materials can be sourced more locally from the area. It has been assumed in this report that the transportation from these quarries to the site can be carried out by semi-trailers, which constitute Class 1A vehicles under the PBS scheme. From RAVnet, all surrounding routes are approved for the movement of these vehicles. It is assumed that the construction phase will include a concrete batching plant on site, allowing all materials to be transported to the site in bulk. In the event that materials could be sourced on-site, as opposed to surrounding quarries, the generated heavy vehicle traffic would be far lower.

The location of quarries in the local area is shown in Figure 10.

Figure 10 Location of local quarries



5.4 Local Road Access to the Site from Truro Road

As discussed in Section 5.1 two options have been assessed for movement of over-dimensional loads from either of two sea port locations. The Sturt Highway from the Northern Expressway near Gawler through to the intersection with Truro Road can then be used to transport loads closer to the vicinity of the wind farm. From this point there are two options using local roads to access the site. These options are;

- Option 1 – Truro Road / Bagot Well Road / Camel Farm Road, or
- Option 2 – Truro Road / Teagle Road / Bagot Well Road / Weaver Road / Camel Farm Road

Both of these options then utilise Flagstaff Hill Road and Mosey Road to the entry point of the proposed site.

Access considerations for these routes, such as intersection turn layouts, bridge crossings and clearances, are discussed in more detail in Section 7.0.

A number of intersections along these two routes present geometric constraints to the transport of 66.7m wind turbine blades. To check the intersections of most concern, turn path checks for the 66.7m blade have undertaken based on available aerial photography. These are included in Appendix B.

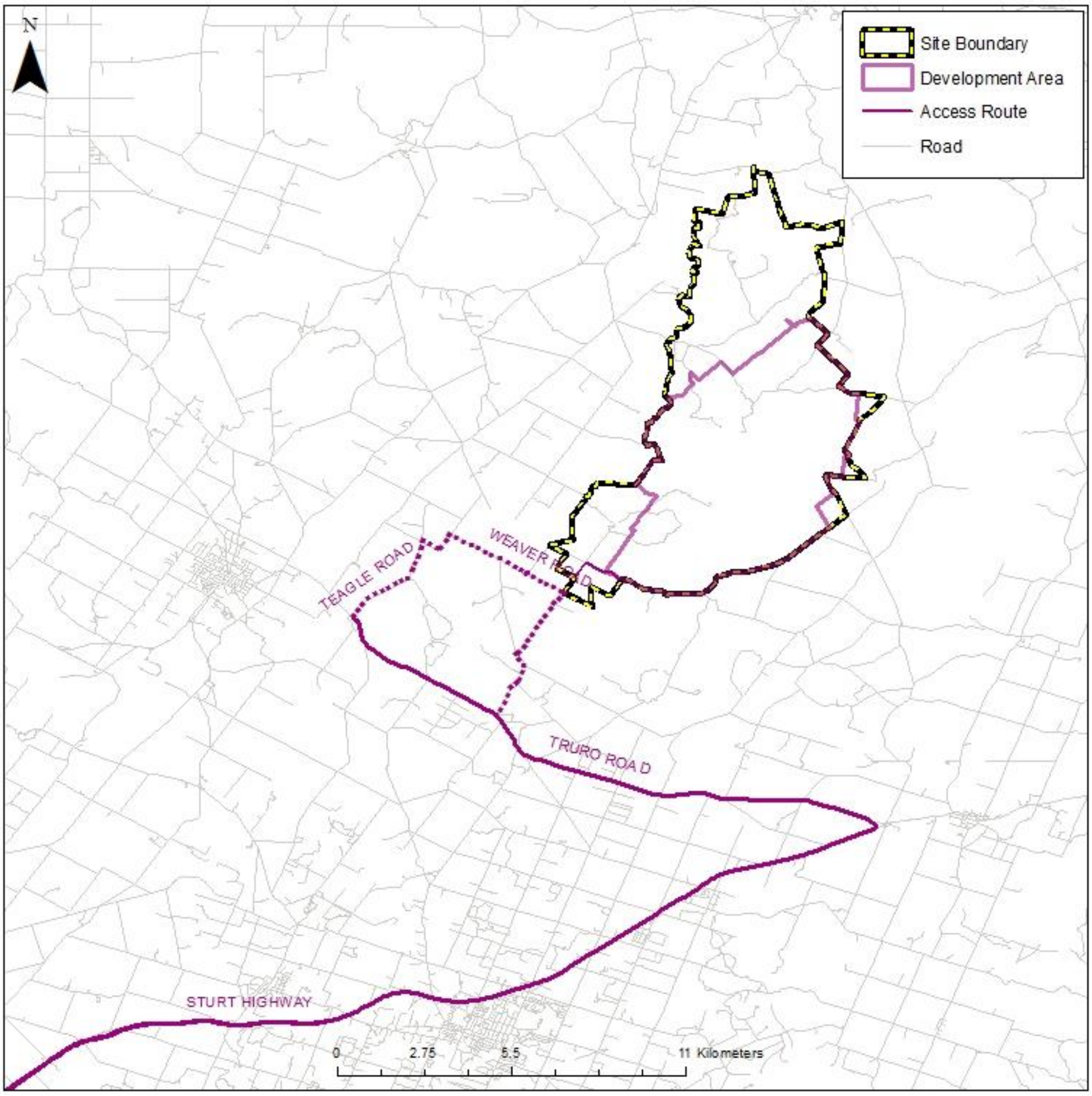
The assessment of intersections using the largest load, being the 66.7m blades indicates that Option 2 will require the greatest extent of modifications to private property at a number of locations the greatest of which is the intersection of Truro Road and Teagle Road.

The locations of most concern are shown in Table 9;

Table 9 Local road intersections presenting possible geometric and load constraints

Option	Constraint location
Option 1 - Truro Road / Bagot Well Road / Camel Farm Road	Sturt Hwy / Truro Rd
	Truro Rd / Bagot Well Rd
	Bagot Well Rd / Camel Flat Rd
	Camel Farm Road / Flagstaff Hill Rd
Option 2 - Truro Road / Teagle Road / Bagot Well Road / Weaver Road / Camel Farm Road	Sturt Hwy / Truro Rd
	Truro Rd / Teagle Road
	Teagle Road (various locations)
	Teagle Road / Bagot Road
	Weaver Road / Camel Farm Road
	Camel Farm Road / Flagstaff Hill Rd

Figure 11 Option 1 & 2 Local road access options to site from Truro Road



5.5 Expected Impact on Road users and the Community

It is expected that, because of the large numbers of heavy vehicles required during the construction and decommissioning phases, there is the potential for the development to have a large impact on road users and the local community. In general, the construction phase will increase daily traffic volumes, which may result in more congested routes for local road users. The most significant impact would be for the sections of the access route that is contained within the metropolitan region, since the vehicles will be required to share main arterial routes with general traffic. By selecting the access route via the Northern Expressway, the impact on road users will be reduced, as this route allows for significant overtaking capacity and reduces the likelihood of frequent stops.

The transportation of components and construction materials may also cause noise and dust impacts during the construction and decommissioning phases that will impact the local residents closer to the wind farm site. As local school bus routes also exist in this area, there may be impacts on these transportation routes. These impacts can be minimised by scheduling over dimensional/mass and heavy vehicle transport during off-peak times to avoid commuter traffic and school bus movements.

6.0 Traffic Impact Assessment

6.1 Introduction

The traffic impact assessment in this section has been made separately for each expected phase of the life of the wind farm, including:

- Construction phase
- Operations phase
- Decommissioning phase

Overall, it is expected that the construction phase will have the highest traffic impact with approximately 175,000 trips generated during the 18 month period. Of these trips, approximately 1,500 will be over dimensional and over mass trips, 34,000 truck trips and 53,000 car trips.

The decommissioning phase is expected to generate a similar amount of traffic, if not marginally less, as a result of the need to remove the infrastructure and rehabilitate the site.

The operations and maintenance phase is likely to have a comparatively minimal traffic impact, as the only transportation required to the site will be associated with monitoring and operation and maintenance.

Should components be required to be replaced during the operational phase of the wind farm, transportation of these items should be as for the same component during the construction phase.

6.2 Construction Phase

6.2.1 Traffic Generation

Table 10 shows the estimated total trips generated throughout the construction phase of the project, based on the following assumptions:

- A trip is a single directional movement, therefore a return trip is considered to be 2 trips
- Construction period is assumed to be 18 months
- An average of 22 working days per month
- Maximum workforce at any one time is 200 employees
- The occupancy rate of each employee vehicle is 3 persons per car

In total, it is estimated that there will be approximately 175,000 trips generated over the 18 month construction period, comprised of:

- 1,500 over dimensional and over mass trips
- 34,000 truck trips
- 53,000 car trips

Table 10 Estimated total trips generated by the proposed wind farm site

Material	Estimated Quantity	Unit	Vehicle Type	Estimated One-Way Vehicle Trips		
				Total trips	Average Trips/Month	Average Trip/Day
Concrete Materials	36000	cubic metres	Semi- trailers	3600	200	9
Reinforcing Steel	1800	Tonnes	Semi- trailers	180	10	0
Road base	252750	Tonnes	Semi- trailers	25275	1404	64
Miscellaneous Equipment and Materials	Nominal	-	Semi- trailers	200	11	1
Wind Turbine Components						
Tower Sections	300	5 section/tower	Over size	600	33	2
Nacelles	120	2 section/nacelle	Over size	240	13	1
Hub	60	1 hub/turbine	Over size	120	7	0
Blades	180	3 blades/turbine	Over size	360	20	1
Substation						
Substation Transformer	2	-	Over size	4	0	0
Switchgear and other substation equipment	Nominal	-	Semi- trailers	240	13	1
Site Work Activities						
Cranes	0	-	Semi- trailers and mobile wheel based cranes	0	0	0
Employees	200	-	Cars/ 4WD	52800	2933	133
Construction Equipment, Plant and Components	1200	-	Various	2400	133	6
Total trips- Traffic Movements						
Over size/ oversize vehicles				1,324	74	3
Trucks				31,895	1,772	81
Cars				52,800	2,933	133
Total				**172,000**	**9,558**	**434**

6.2.2 Trip Distribution

Figure 12, Figure 13 and Figure 14 show the estimated trip distribution for cars, trucks and over dimensional and over mass vehicles, respectively. All estimates assume that the percentage of vehicles on each potential site access route is proportional to the existing route use. For employee access in cars and 4WDs, it is assumed that most employees will be travelling from the Greater Metropolitan Region of Adelaide, using Thiele Highway or Sturt Highway to access the site, with some travelling from surrounding rural regions, such as Truro and Eudunda. From this, it is estimated that 36.5% of cars will be travelling on Thiele Highway from the south, 2.2% on Thiele Highway from the north, 46.2% on Sturt Highway from the south, 1.8% on Eudunda Road from the north, and 13.3% on Sturt Highway from the east.

Based on the location of surrounding quarries and the access to the site from the Port of Adelaide, the distribution of truck and semi-trailer access to the site is estimated to be 30.1% along Thiele Highway and 69.9% along Sturt Highway. Of the trucks travelling on Sturt Highway, approximately 6.4% of the total trips may use Belvidere Road to access Truro Road, while 63.5% may use the turn-off from Sturt Highway.

The limitations on over dimensional and over mass vehicles requires that 100% of all vehicles transporting the wind turbine components to the site use the Sturt Highway-Truro Road-Bagot Well Road (or Teagle Road route) as shown below.

Figure 12 Trip distribution for cars and 4WDs accessing the site during construction phase

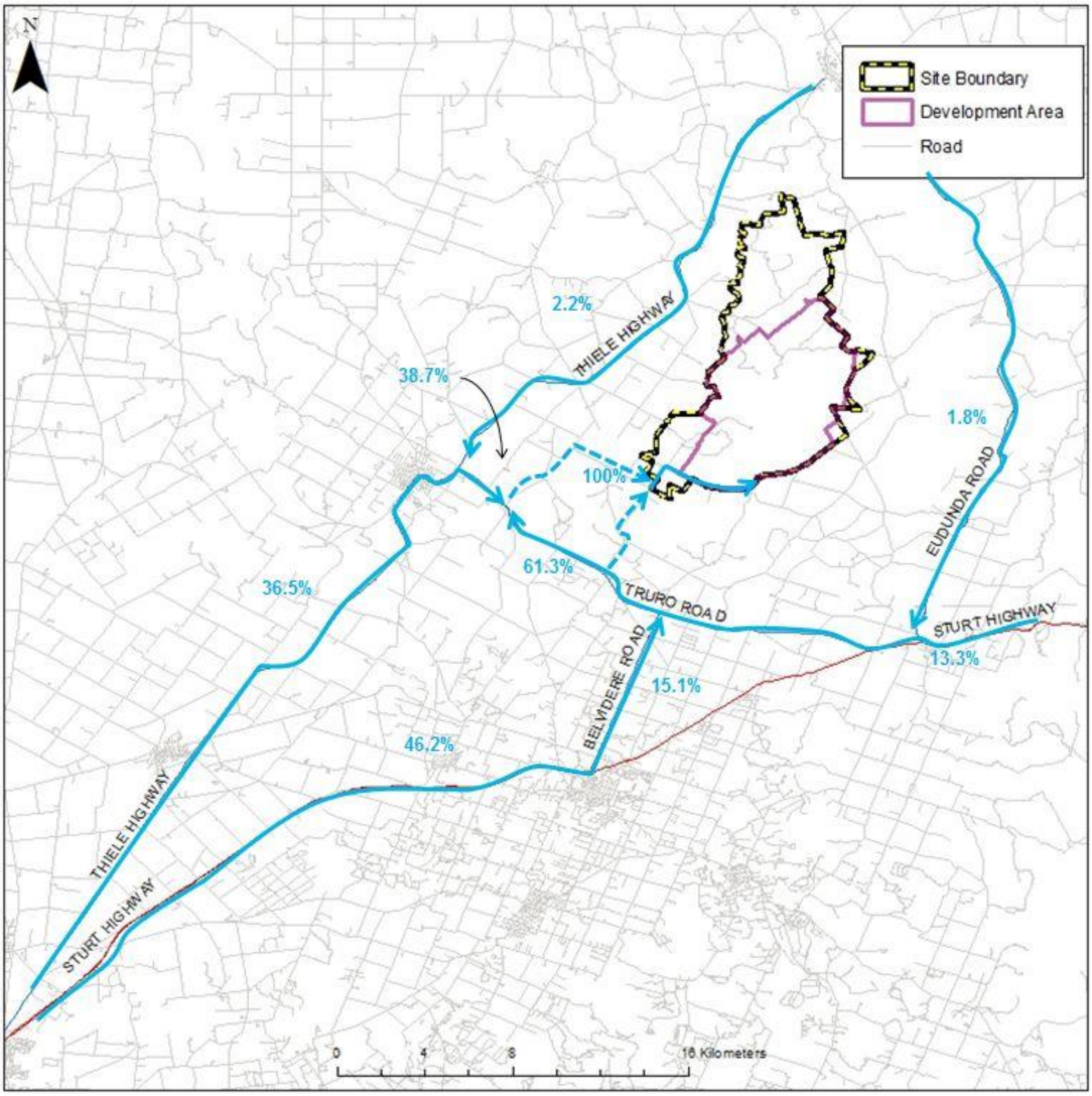


Figure 13 Trip distribution trucks carrying construction materials, excluding oversize and overweight vehicles

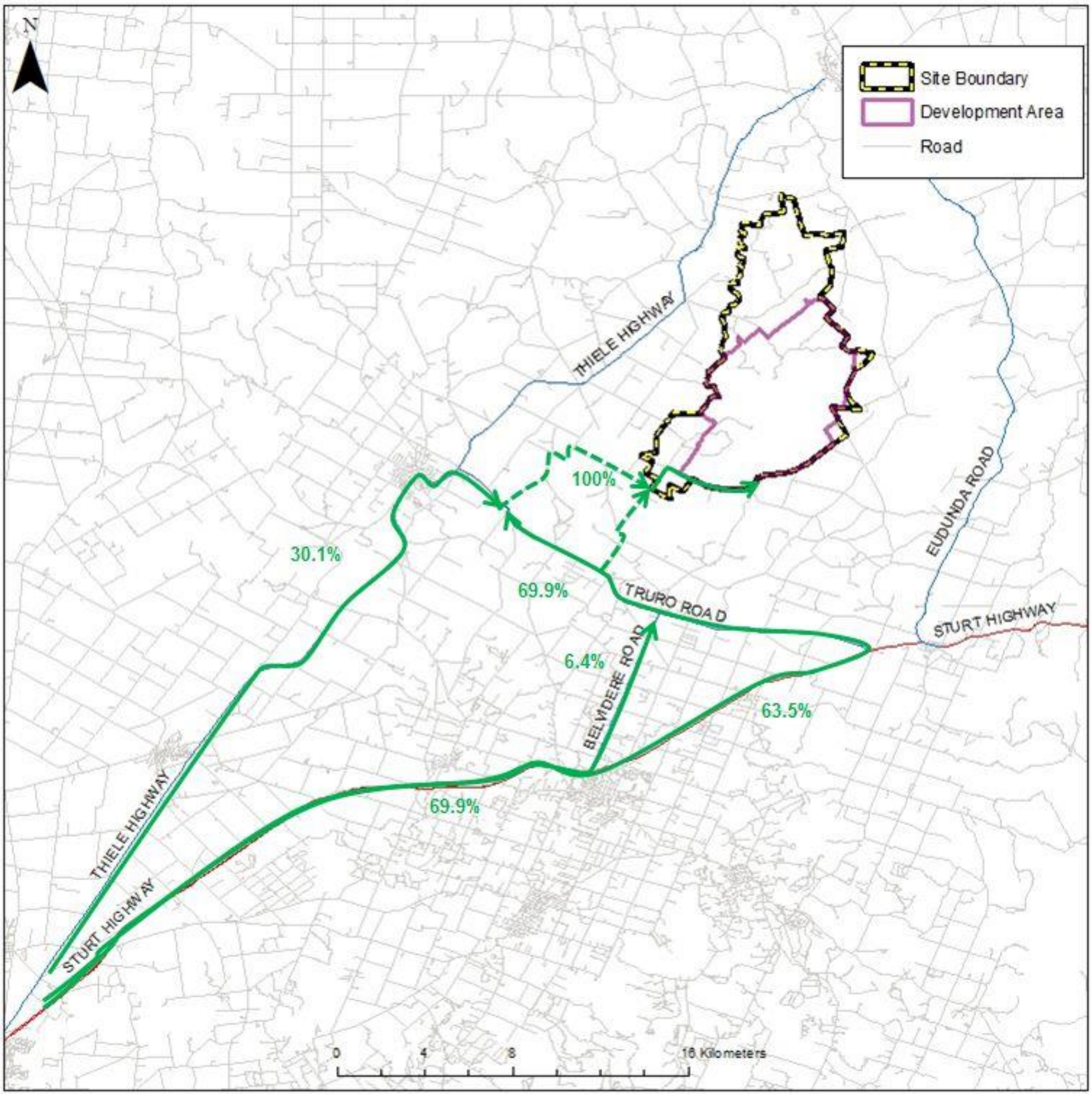
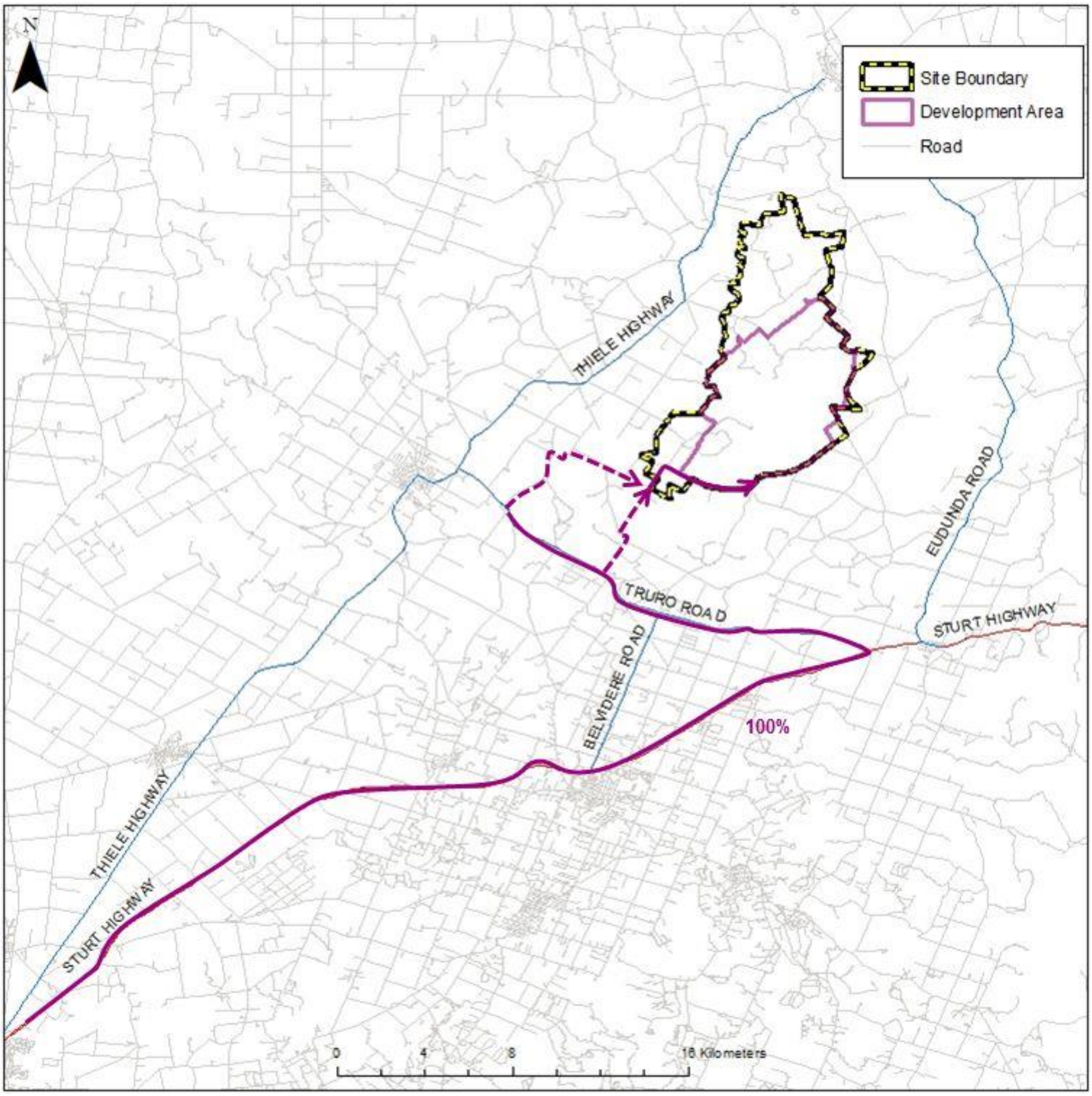


Figure 14 Trip distribution for over dimensional and overweight vehicles transporting components to site



6.2.3 Impact Assessment

Based on the derived trip distribution, the traffic generated on each road segment during the construction phase is summarized in Table 11 below. The increase in daily traffic along most routes is less than 10%. The largest percentage increase occurs along Truro Road, as this is the only access route from the Sturt Highway and is not currently heavily used. The increase in daily traffic on Truro Road is;

- from the west, 6% increase in total traffic (15% increase in heavy vehicles), and
- from the east, 11.25% increase in total traffic (40.8% increase in heavy vehicles)

As no traffic data was available for Teagle Road or Bagot Well Road, the percentage increase has not been calculated; however it is likely that the current traffic volumes are low. As a result there is likely be a noticeable impact from the development construction phase.

Table 11 Comparison of existing traffic volumes against estimated traffic generated by the wind farm

Impacted Road	Existing Traffic Volume		Additional Volume during Construction Period			Total Traffic Volume during Construction		% Increase	
	Total AADT	HV AADT	Cars and 4WDs	Trucks	Overweight and Oversize	Total AADT	HV	Total AADT	HV
Thiele Hwy (Between Truro Rd and Tarlee Rd)	2100	230	49	24	-	2173	254	3.48	10.43
Between Thiele Hwy and Marrabel Rd	4400	230	49	24	-	4473	254	1.66	10.43
Thiele Hwy (near Kapunda)	3400	280	49	24	-	3473	304	2.15	8.57
Between RN4366 and RN4372	2500	210	49	24	-	2573	234	2.92	11.43
Between Thiele Hwy and Freeling	3600	330	49	24	-	3673	354	2.03	7.27
Thiele Hwy	4300	340	49	24	-	4373	364	1.70	7.06
Thiele Hwy (north of Truro)	1200	150	3	-	-	1203	150	0.25	0.00
Sturt Hwy (Tanunda)	12000	1980	62	56	3	12121	2039	1.01	2.98
Sturt Hwy (Between Tanunda and Daveyston Road RN4372)	8500	1400	62	56	3	8621	1459	1.42	4.21
Between RN4366 and RN4363	5200	380	62	56	3	5321	439	2.33	15.53
Sturt Hwy (between Belvidere and Truro)	4300	900	18	56	3	4377	959	1.79	6.56
Sturt Hwy (Truro Rd to Truro)	4200	1100	18	-	-	4218	1100	0.43	0.00
Sturt Hwy (east of Truro)	3200	950	18	-	-	3218	950	0.56	0.00
Eudunda Rd	1000	100	2	-	-	1002	100	0.20	0.00
Belvidere Rd	900	90	62	5	-	967	95	7.44	5.56
Truro Rd (west of Kapunda)	1200	120	52	24	-	1276	144	6.33	20.00
Truro Rd (east of Truro)	1200	120	20	51	3	1274	174	6.17	45.00
Truro Rd (between Belvidere Rd and Teagle Rd)	1200	120	82	56	3	1341	179	11.75	49.17
Teagle Rd	-	-	133	81	3	217	84	-	-

*Department of Planning, Transport and Infrastructure (2016b)

6.3 Operations Phase

The traffic impact of the operations phase is expected to be minimal, as the proposed design allows for stand-alone remote operation. This means that the need for staff to access the site on a daily basis is minimal. Initially, the wind farm will require testing and commissioning which will require up to 30 staff each day over a 2-4 month period. This will reduce once the wind farm begins operation, for which staff will be required on site to undertake regular site inspections and complete maintenance. This will require approximately 10 staff members each day. The transportation of staff to the site is likely to be in light commercial vehicles, and will access the route via the routes outlined in Figure 12. These trips will not create a significant impact on the traffic volumes in the area.

In the event that any unscheduled, large scale maintenance occurs, such as the replacement of turbine components, additional heavy vehicles will be required to transport these components to the site as it is not expected that these will be able to be fabricated on site. As with the previous assessment of the turbine component delivery in Section 3.1, this may require the relevant over size and over dimensional vehicles and access the site using the route outlined in Figure 14. Similarly, associated construction vehicles will access the site according to the routes described in Figure 13.

6.4 Decommission Phase

As the operation of the proposed wind farm comes to completion, the decommissioning of the site depends on the decision to upgrade the site with new wind turbines or to dismantle the infrastructure and rehabilitate the site. For both situations, the traffic impacts are expected to be equal to, or slightly less than, the construction phase, since most of the supporting infrastructure on the site will have already been constructed.

An additional assessment of these impacts would be required at this stage as the life span of this wind farm is approximately 20 to 25 years (Department of Industry, Geoscience Australia, Bureau of Resources and Energy Economics 2014), in which time traffic volumes and road usage would have changed.

7.0 Access Considerations

Due to the high volume of heavy vehicles and over-dimensional loads requiring transportation during the construction phase in this project, consideration must be given to the various road layouts and capacities and the impacts that this might have. The various issues to be considered include:

- Road layout such as intersection turn constraints, capacity of pavements, water crossings and culverts, and vertical road alignment
- Vegetation and low level powerline clearance
- Generation of noise and dust

As discussed in previous sections, there are two options available to access the Sturt Highway,

- Option A – Port of Adelaide to Sturt Highway, and
- Option B – Port Pirie to Sturt Highway

Once the components have been transported along the Sturt Highway, there are two local road options to access the wind farm site. These are;

- Option 1 – via Bagot Well Road
- Option 2 – via Teagle Road

Both of these options use Flagstaff Hill Road and Mosey Road to access the Wind Farm site.

The following section is a more detailed investigation into the potential constrains along these route options.

The assessment has been undertaken for the largest component to be moved (being the 67m long blades) under the assumption that all other components will be able to be moved along the same route once suitable for the movement of the blades.

The access considerations have been based on the minimum turn radius assumption provided in *Road Crane Pad and Hardstand Specifications V105-V110-V112-V117-V126*. It is noted that the V136 blade is 5m longer than the V126 (V136=66.7m, V126=61.7m), and as such the vehicle minimum turn radius has been assumed to be 5m greater than the V126 model.

7.1 Local Road Access Option 1: Bagot Well Road

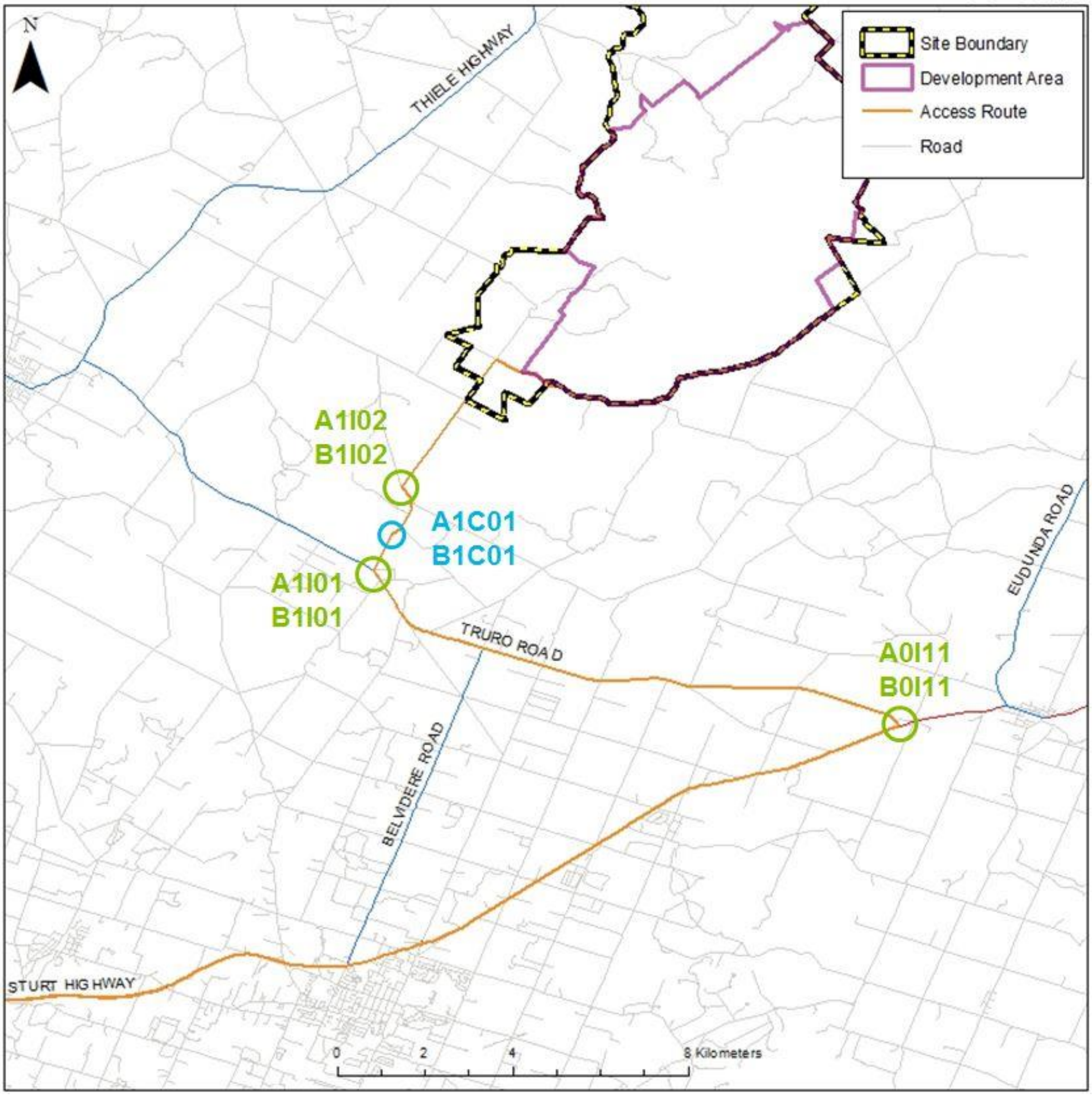
7.1.1 Main and Local Road Layout

Figure 15 shows the main and local road layout for the access option to the site via Bagot Well Road. All necessary turns that have been assessed and water crossings are indicated on this figure in green and blue circles, respectively.

Table 12 Locations assessed along Option 1

Location	Relevant reference drawing
Sturt Highway/Truro Road	A0I11 and B0I11
Truro Road / Bagot Well Road	A1I01 and B1I01
Bagot Well Road / Camel Farm Road	A1I02 and B1I02
Camel Farm Road / Flagstaff Hill Road	A0I12 and B0I12

Figure 15 Identified access considerations for Bagot Well Road route (turns are indicated in green and numbered, water crossings are indicated in blue and lettered)



7.1.2 Intersection Turn Layout

The route includes three turns that may present access constraints for over dimensional vehicles. Images of these locations are shown in Figure 16. The requirements to make these turns are given in Table 13 and the street furniture that may need to be temporarily removed or relocated are shown in Figure 17 (turn 1) and Figure 18 (turn 2).

Figure 16 Google Street View images of turns in the access route via Bagot Well Road

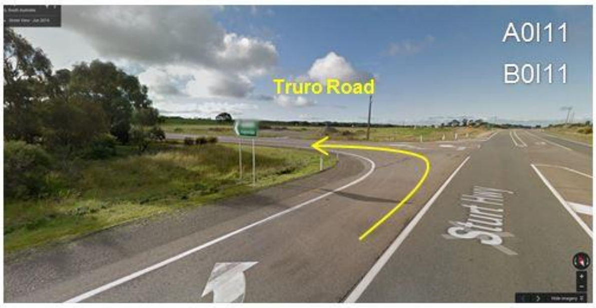
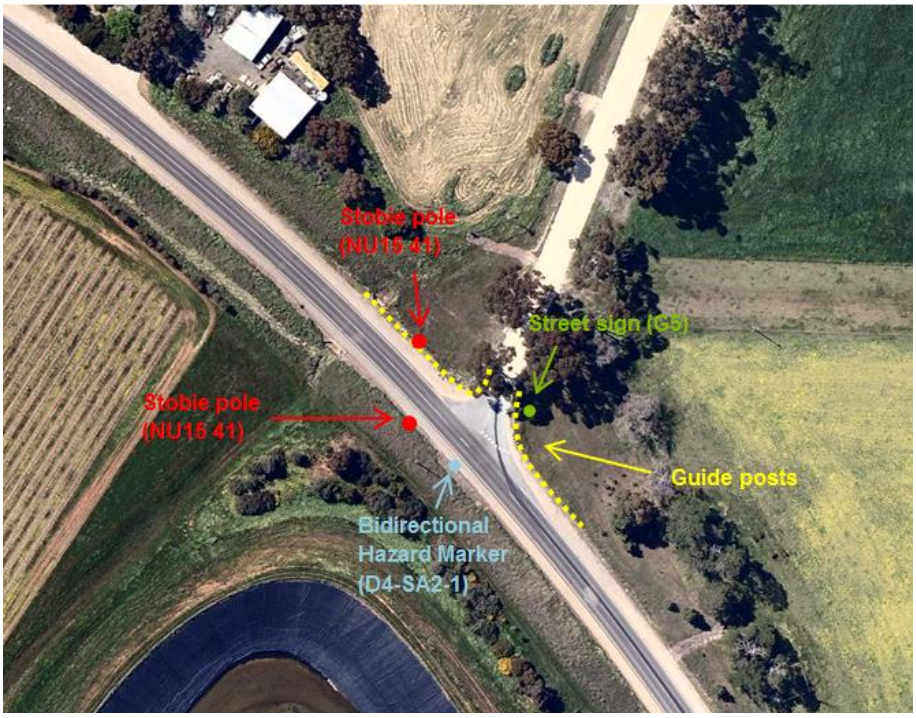


Table 13 Access requirements at intersections for Bagot Well Road access

Turn	Roads	Access Requirements
A0I11 B0I11	Sturt Highway to Truro Road	• Swale on inside of turn • Whole of oncoming traffic lanes • Will require movement/removal of street furniture
A1I01 B1I01	Truro Road to Bagot Well Road	• Verge on outside of turn on Truro Road • Will require movement/removal of street furniture
A1I02 B1I02	Bagot Well Road to Camel Farm Road	• 1,145 m^2 of land within property bounds on inside of turn • Verge on outside of turn on Bagot Well Road

Figure 17 Street furniture located on turn A0I11/B0I11

Figure 18 Street furniture located on turn A1I01/B1I01



7.1.3 Road Pavements, Bridges and Culverts

In general, the Sturt Highway is currently approved for PBS Class 2A vehicles (26m B-doubles) and so experiences a high volume of such vehicles. The increase in heavy vehicles as a result of the development is low in proportion to existing heavy vehicle movements of the Sturt Highway and it is expected that the current road pavements will be sufficiently designed to cope with the extra volume during the construction phase. The transportation of the nacelle, hub and transformers, however, exceed mass limits and so the road pavements and structures will be required to be assessed in order to obtain a permit to allow transport of these loads.

Truro Road, however, will experience a significant increase in heavy vehicle use, as it is not currently a high use heavy vehicle route. In this situation, the increase in heavy vehicles may cause some damage to the road, particularly if high volume movements are undertaken in wetter conditions. Pre and post construction assessments should be undertaken to assess the required rehabilitation of road pavements. All unsealed roads are expected to require upgrades as they will experience a significant increase in daily traffic. Over-mass loads should ideally be transported in dry weather only to avoid excessive damage to unsealed roads.

Bagot Well Road crosses St Kitt's Creek in the location indicated in Figure 15 as A1C01. Figure 19 shows an aerial view of this crossing, indicating that the crossing is bridge structure. Given the current low traffic volumes of this local area road and Council do not have a load rating for the bridge, a structural assessment will need to be undertaken to ensure that it can sustain the over mass vehicle loads., If the Bagot Well Road access option is chosen as the access route, any upgrades recommended by the structural assessment would need to be designed to support these loads.

Figure 19 Nearmap image of Crossing A

7.1.4 Vegetation and Power Line Clearance

The majority of arterial roads on the proposed access route have adequate vegetation and power line clearances as these routes are designed for high speed and high volume traffic. However, some vertical envelope restrictions currently exist along Truro Road and the start of Bagot Well Road. Figure 20 shows an example of the vegetation that exists along Truro Road that may impede the access of over dimensional vehicles on the route and Figure 21 shows vegetation restrictions on the intersection of Truro Road and Bagot Well Road. In most instances, the clearance restrictions are a result of overhanging trees on both sides of the road, which will require pruning to achieve adequate clearance.

Figure 20 Example of vegetation restrictions for over dimensional vehicles on Truro Road

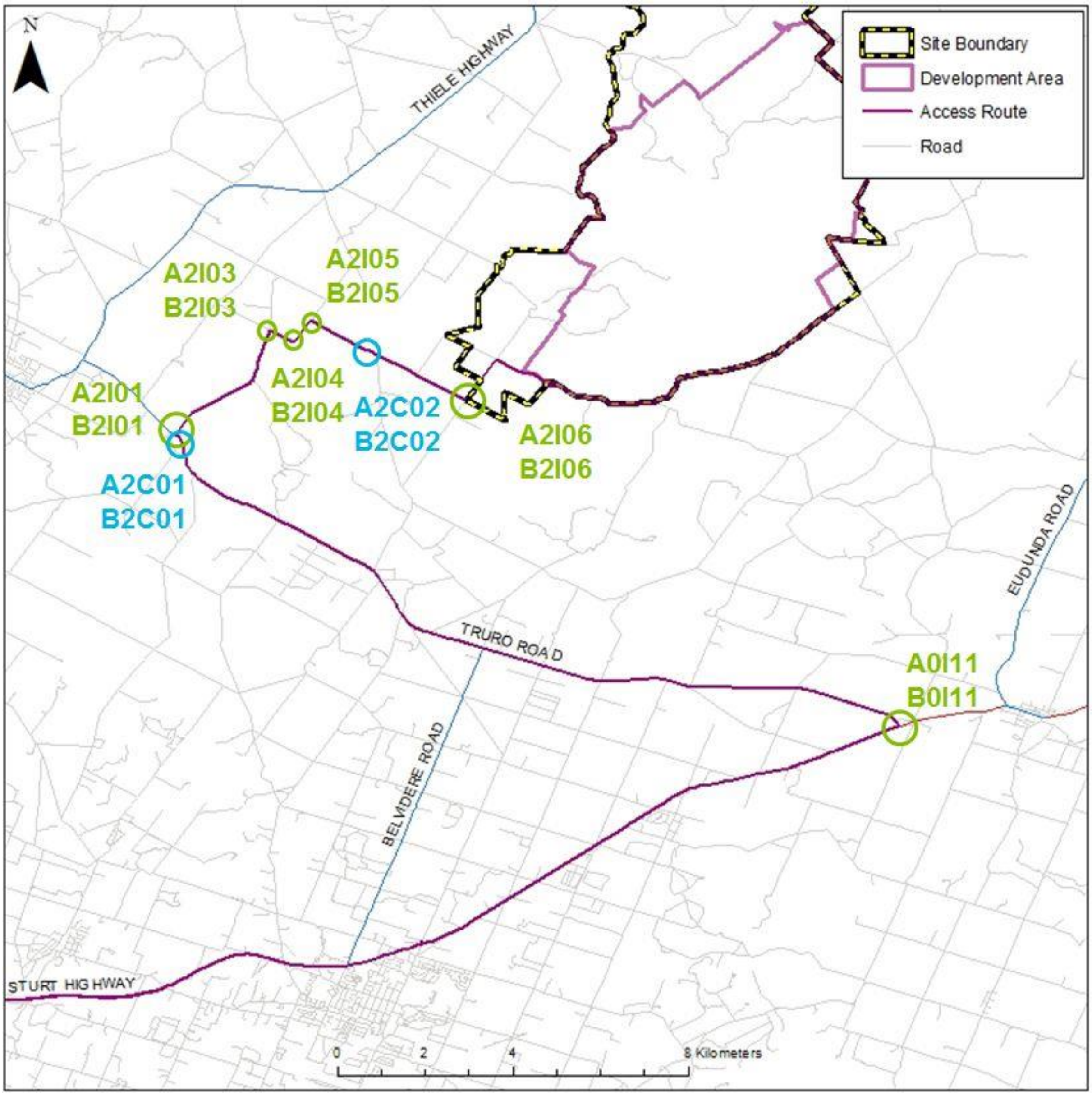
Figure 21 Vegetation restrictions for over dimensional vehicles on Bagot Well Road

7.2 Option 2: Teagle Road

7.2.1 Main and Local Road Layout

Figure 22 shows the main and local road layout for the access option to the site via Teagle Road. All necessary turns and water crossings are indicated in green and blue, respectively.

Figure 22 Identified access considerations for Teagle Road route (turns are indicated in green and water crossings are indicated in blue)



7.2.2 Intersection Turn Layout

This route includes six turns that may present access constraints for over dimensional vehicles. Images of these locations are shown in Figure 23. The requirements to make these turns are given in Table 14 and the street furniture that may need to be temporarily removed or relocated are shown in Figure 17 (for A0I11/B0I11) and Figure 24 (for A2I01/B2I01).

Figure 23 Google Street View images of turns in the access route via Teagle Road

Table 14 Access requirements at intersections for Teagle Road access

Turn	Roads	Access Requirements
A0I11 B0I11	Sturt Highway to Truro Road	See Table 13
A2I01 B2I01	Truro Road to Teagle Road	• Verge on outside of turn on Truro Road • 2,303 m^2 of land within property bounds on outside of turn on Teagle Road • Will require movement/removal of street furniture
A2I03 B2I03	Teagle Road	• 905 m^2 of land within property bounds on inside of turn • Some use of verge on outside of turn on Teagle Road
A2I04 B2I04	Teagle Road	• 375 m^2 of land within property bounds on inside of turn • Some use of verge on outside of turn on Teagle Road
A2I05 B2I05	Teagle Road to Bagot Well Road	• 515 m^2 of land within property bounds on inside of turn • Some use of verge on outside of turn on Teagle Road
A2I06 B2I06	Weaver Road to Camel Farm Road	• 230 m^2 of land within property bounds on inside of turn • Some use of verge on outside of turn on both roads

Figure 24 Street furniture located on A2I01/B2I01 (Truro Road / Teagle Road)

This intersection presents the largest constraint to movement of the 66.7m blades and if used will require significant modification to enable the right hand turn to be undertaken. This turn will also have significant impact of the adjacent land owners buildings.

7.2.3 Road pavements, Bridges and Culverts

As discussed in Section 7.1.3, the increase in heavy vehicle traffic on Sturt Highway is acceptable, with over mass vehicle movements requiring permitting, however Truro Road will experience greater than normal traffic and may need to be assessed after the construction period to determine if any upgrades are required. All unsealed roads will also need to be upgraded for access to the site.

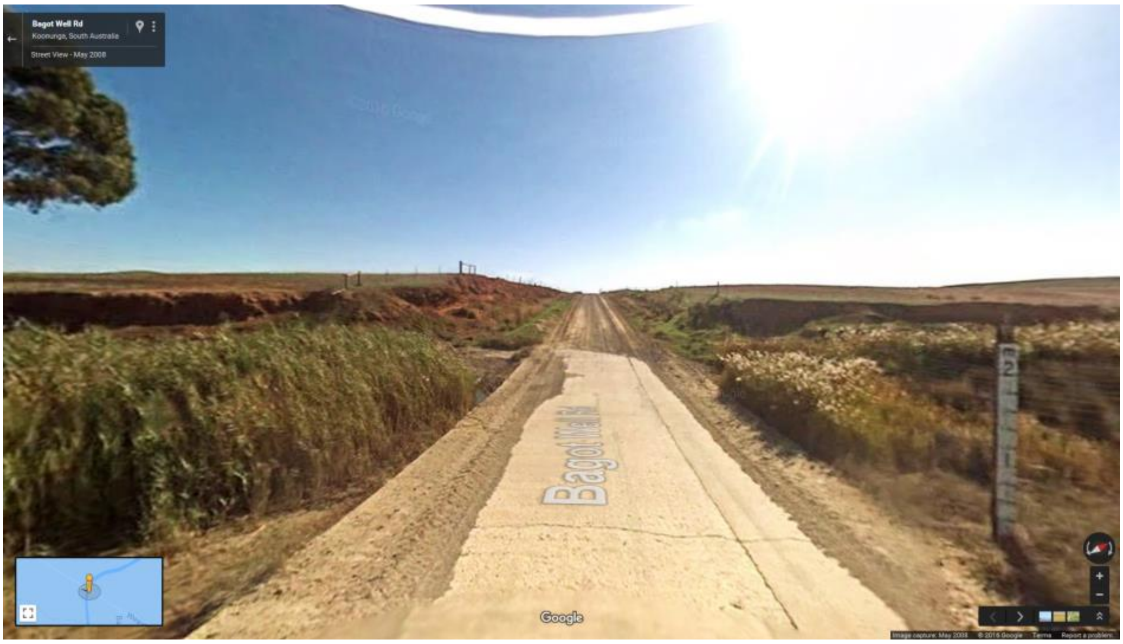
This route crosses the Light River in two locations, once on Truro Road, indicated in Figure 22 as A2C01/B2C01, and once on Bagot Well Road, indicated as crossing A2C02/B2C02. Figure 25 and Figure 26 show images of these crossings. A2C01/B2C01 is a formal bridge whereas A2C02/B2C02 is via a causeway through the river channel. The Light River is ephemeral, and therefore typically only flows during the winter and spring months. As it is assumed that the construction phase will occur over 18 months, it is likely that access will be required when the river is flowing over the road. Two options are available in this situation:

1. A bridge or culvert can be installed at A2C02/B2C02 to allow for continual movement of vehicles at all times during the construction period.
2. Restrict transportation of over dimensional and over mass vehicles to summer and autumn months when the river is not flowing over the road.

An additional structural assessment will need to be undertaken for A2C01/B2C01 to ensure that it can sustain the over mass vehicle loads and, if Option 1 were to be chosen, the culvert or bridge would also need to be designed to sustain this load.

Figure 25 Google Street View of A2C01/B2C01

Figure 26 Google Street View of A2C02/B2C02



7.2.4 Vegetation and Power Line Clearance

As discussed in Section 7.1.4, some overhanging trees exist along Truro Road, restricting the ability for safe access by over dimensional vehicles. This is also the case at the intersection of Truro Road and Teagle Road. In these instances, it will be necessary to prune the trees back to provide safe clearance for these vehicles.

7.2.5 Delivery of Substation Components

The two proposed substation are shown in Figure 6. The wind farm substation can be accesses via the selected route from the Sturt Highway.

The terminal substation is proposed to be located at the 275 kV tee in adjacent the Sturt Highway can therefore be accessed easily from the Sturt Highway.

As discussed in Section 5.1, the substation components are over dimensional or over mass and will require permits to be transported to the site.

7.3 Potential Generation of Noise and Dust

The use of heavy vehicles on these routes will generate an increase in noise and dust from the current level, particularly on rural roads off Truro Road, where the majority of the network s unsealed. There are a number of measures that can be taken to reduce noise and dust including:

- Restrict vehicle movements to and from the site to off peak times to reduce the impact of noise on surrounding residents
- Provide for clear turning circles to reduce engine noise associated with revving and reversing beeping and generation of excess dust
- No vehicles shall be left idling on any roads in the vicinity of residential properties
- Enforce vehicle speed limits on the construction site and rural roads off Truro Road to minimise the generation of dust
- Minimise soil deposit on surrounding roads, using rumble grids if needed

8.0 Permits

Permits are issued by departmental bodies and are required for the transportation of an over dimensional or over mass indivisible item. A permit is required for each individual movement and prescribes specific conditions to the movement of that vehicle such as travel times, use of pilot vehicles and police escorts, and route restrictions. Permits are required for both state and council managed roads.

Table 15 Permits required for the construction phase

Component	Permit Required	Regulating Body	Conditions*
Nacelle	Over Dimensional and Over Mass	DPTI	• 2 pilot vehicles required per transport • Warning signs at front and rear of vehicle • Warning lights, delineators and flags required on projections • Travel only between sunrise and sunset, and not between 7am-9am and 4pm-6pm in the Adelaide zone
Hub	Over Dimensional and Over Mass	DPTI	• 2 pilot vehicles required per transport • Warning signs at front and rear of vehicle • Warning lights, delineators and flags required on projections • Travel only between sunrise and sunset, and not between 7am-9am and 4pm-6pm in the Adelaide zone
Blades	Over Dimensional	DPTI	• 2 pilot vehicles required per transport • Warning signs at front and rear of vehicle • Warning lights, delineators and flags required on projections • Must not travel between 7am-9am and 4pm-6pm in the Adelaide zone
Tower Components	Over Dimensional	DPTI	• 2 pilot vehicles required per transport • Warning signs at front and rear of vehicle • Warning lights, delineators and flags required on projections • Travel only between sunrise and sunset, and not between 7am-9am and 4pm-6pm in the Adelaide zone
Substation Transformer	Over Dimensional and Over Mass	DPTI	• 2 pilot vehicles required per transport • Warning signs at front and rear of vehicle • Warning lights, delineators and flags required on projections • Travel only between sunrise and sunset, and not between 7am-9am and 4pm-6pm in the Adelaide zone

* Department for Transport, Energy and Infrastructure (2008, 2006)

9.0 Safety Consideration

9.1 Signage

Most semi-trailers and smaller vehicles transporting materials and equipment to the site will pose a low safety risk to other road users and therefore will not require any additional signage, other than what is currently required on all vehicles.

Over dimensional and over mass vehicles, however, will require additional signage for other road users. This signage is determined by the relevant permits required for each trip and is sum

arised in Table 15. In addition to this signage, a police escort will assist in promoting road user awareness and the safe and efficient management of local traffic, particularly on one lane routes where overtaking or passing may not be possible.

9.2 Sight Distance at Intersections

For all general access vehicles, the sight distances at most turns along the routes are adequate, as are those for restricted access vehicles, since all routes have been permitted for restricted vehicle access by DPTI and published on RAVnet (2016a). A potential sight distance issues exists on the western approach to the Teagle and Truro Roads intersection, which may increase the difficulty in undertaking this movement for heavy vehicles. Should this intersection be used the intersection will require upgrading to provide sufficient site stopping distance to the intersection. This will likely involve significant cutting of the batter and clearance to enable intersection site distance for the require speed.

Figure 27 Sight restrictions on Truro Road approaching Teagle Road

9.3 Hours of transport operations

As discussed in Section 5.5 and outlined in Table 15, the hours of transport operations on the access route will be restricted to minimise the impact on road users and improve safety conditions.

For the safety of other road users, neither over dimensional or over mass vehicles may travel during periods of low visibility, as a result of daylight or unfavourable weather conditions. Over mass vehicles must only travel within the Adelaide metropolitan region outside of peak times and between the hours of sunrise and sunset as published in the South Australian Government Gazette. Over dimensional vehicles must only travel outside of peak times.

10.0 Conclusions and Recommendations

The traffic generated by the Twin Creek wind farm development is likely to have a noticeable impact on the road network both in the local area and the broader transport network. The largest impact is generated by the construction phase of the development while other phases (operations and maintenance work) will have little impact. During the construction phase the impact will extend over approximately an 18 month period, requiring an estimated 175,000 trips, made up of approximately:

- 1,500 over dimensional and over size trips
- 32,000 truck trips
- 53,000 car trips

The decommission phase is likely to generate a similar amount of traffic, however it is recommended that another traffic impact assessment be carried out closer to the decommissioning date.

In considering the route options, from either Port of Adelaide or Port Pirie to the Sturt Highway and from the Sturt Highway to the Wind Farm site the preferred access route for the transportation of wind turbine components and substation components is from the Port of Adelaide, via Port River Expressway, Port Wakefield Road, the Northern Expressway, Sturt Highway, Truro Road, Bagot Well Road, Flagstaff Hill Road and Mosey Road to the site access point (ie. Option A to Sturt Highway and Option 1 from Sturt Highway to the site)

The majority of vehicles accessing the site will be either staff vehicles or semi-trailers, however, for the over dimensional and over mass vehicles, the appropriate permits and assessments must be sought and carried out. Permits are required for each vehicle and each trip, and assessments into the structural capacity of the roads and bridges along the route will be needed for the over mass trips. The permits outline the necessary safety considerations for the movement of these vehicles, such as use of a police escort, pilot vehicles, appropriate signage and hours of transport operations.

Access for these over dimensional trips is generally adequate along the recommended route. The majority of the route is on restricted vehicle access approved routes, however, some tree trimming, movement of street furniture and access into private land is likely to be required in isolated locations. The St Kitts Creek crossing on Bagot Well Road will require a detailed structural assessment and potential upgrade for over dimensional and over size vehicles. In general, the sight distances along the route are considered adequate for all vehicles, given the appropriate escorts are used for over dimensional vehicles. All movement of over-dimensional and over-mass components should be undertaken with regard to weather conditions to avoid excessive damage to unsealed road pavements.

It is recommended that in the preparation of the Traffic Management Plan, further community and stakeholder consultation is undertaken to ensure that the recommended access route is acceptable and that the implementation of noise and dust mitigation measures is adequate.

In conclusion, allowing for the implementation of mitigation measures and compliance with permit conditions, the impacts from traffic and traffic related activities are considered acceptable for the area in which the Twin Creek Wind Farm is proposed.

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Appendix A

Vestas 3MW Product Brochure

Appendix A Vestas 3MW Product Brochure

Vestas

3 MW PLATFORM

Wind. It means the world to us.™

Are you looking for the maximum return on **your investment** in wind energy?

Wind energy means the world to us. And we want it to mean the world to our customers, too, by maximising your profits and strengthening the certainty of your investment in wind power.

That's why, together with our partners, we always strive to deliver cost-effective wind technologies, high quality products and first class services throughout the entire value chain. And it's why we put so much emphasis on the reliability, consistency and predictability of our technology.

We have more than 35 years' experience in wind energy. During that time, we've delivered more than 77 GW of installed capacity in 75 countries. That is more than anyone else in the industry. We currently monitor over 33,000 wind turbines across the globe. All tangible proof that Vestas is the right partner to help you realise the full potential of your wind site.

What is the 3 MW Platform today?

The 3 MW platform was introduced in 2010 with the launch of the V112-3.0 MW®. Over 11 GW of the 3 MW platform has been installed all over the world onshore and offshore making it the obvious choice for customers looking for highly flexible and trustworthy turbines.

Since then the 3 MW platform was upgraded and new variants were introduced utilising untapped potential of the platform. All variants carry the same nacelle design and the hub design has been re-used to the largest extend possible. In addition, our engineers have increased the nominal power across the entire platform improving your energy production significantly.

With this expansion, the 3 MW platform covers all IEC wind classes with a variety of rotor sizes and a higher rated output power of 3.45 MW.

You can choose from the following turbines on the 3 MW platform:

- V105-3.45 MW™ – IEC IA
- V112-3.45 MW™ – IEC IA
- V117-3.45 MW™ – IEC IB/IEC IIA
- V126-3.45 MW™ – IEC IIB
- V126-3.45 MW™ – IEC IIA
- V136-3.45 MW™ – IEC IIB/IEC IIIA

All variants of the 3 MW platform are based on the proven technology of the V112-3.0 MW® with a full-scale converter, providing you with superior grid performance.

Our 3 MW platform is designed for a broad range of wind and site conditions, enabling you to mix turbines across your site or portfolio of sites, delivering industry-leading reliability, serviceability and exceptional energy capture optimising your business case.

All turbine variants are equipped with the same ergonomically designed and very spacious nacelle which makes it easier for maintenance crews to gain access, so they can reduce the time spent on service while maximizing the uptime without compromising safety. All turbines can be installed and maintained using standard installation and servicing tools and equipment further reducing the operation and maintenance costs by minimising your stock level of spare parts.

+58,000

The V112-3.45 MW® and the other 3 MW variants advance the already proven technology powering over 58,000 installed Vestas turbines worldwide - more than any other supplier.

How does our technology generate **more energy?**

More power for every wind site
V112-3.45 MW™, V117-3.45 MW™, V126-3.45 MW™ and V136-3.45 MW™ are available with several noise modes to meet sound level restrictions with an optimised production. The power system enables superior grid support and it is capable of maintaining production across severe drops in grid voltage, while simultaneously minimising tower and foundation loads. It also allows rapid down-rating of production to 10 per cent nominal power.

Proven technologies - from the company that invented them
The 3 MW platform is a low-risk choice. It is based on the proven technologies that underpin more than 58,000 Vestas turbines installed around the world. Using the best features from across the range, as well as some of the industry's most stringently tested components and systems, the platform's reliable design minimises downtime – helping to give you the best possible return on your investment.

With an operating range that covers all wind classes, our 3 MW platform delivers unrivalled energy production. The proven blade technology from the V112-3.0 MW® is used on the V105-3.45 MW™, the V112-3.45 MW™ and on the V117-3.45 MW™. The industry known structural shell blades are used on the V126-3.45 MW™ and V136-3.45 MW™- a technology which is also used on the 2 MW V110-2.0 MW™ variant.

Reliable and robust
The Vestas Test Centre is unrivalled in the wind industry. We test most nacelle components using Highly Accelerated Life Testing (HALT) to ensure reliability. For critical components, HALT identifies potential failure modes and mechanisms. Specialised test rigs ensure strength and robustness for the gearbox, generator, yaw and pitch system, lubrication system and accumulators. Our quality-control system ensures that each component is manufactured to design specifications and performs at site. We systematically monitor measurement trends that are critical to quality, locating defects before they occur.

The 3 MW platform covers all wind segments enabling you to find the best turbine for your specific site.

WINDCLASSES - IEC

TURBINE TYPE	IEC III (6.0 - 7.5 m/s)	IEC II (7.5 - 8.5 m/s)	IEC I (8.5 - 10.0 m/s)
3 MW TURBINES			
V105-3.45 MW™ IEC IA			Standard IEC conditions
V112-3.45 MW™ IEC IA			Standard IEC conditions
V117-3.45 MW™ IEC IB/IEC IIA		Standard IEC conditions	Standard IEC conditions
V126-3.45 MW™ IEC IIA		Standard IEC conditions	Site dependent
V126-3.45 MW™ IEC IIB	Standard IEC conditions	Standard IEC conditions	
V136-3.45 MW™ IEC IIB/ IEC IIIA	Standard IEC conditions	Standard IEC conditions	

■ Standard IEC conditions ■ Site dependent

Options available for the 3 MW platform

An option is an extra feature that can be added to the turbine to suit a project's specific needs. By adding options to the standard turbine, we can enhance the performance and adaptability of the wind power project and facilitate a shorter permitting cycle at restricted sites. The options can even be a decisive factor in realising your specific project, and the business case certainty of the investment.

Here is a list of the options available for the 3 MW platform:

- High Wind Operation
- Power Optimised Mode
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Nacelle Hatch for Air Inlet
- Aviation Lights
- Aviation Markings on the Blades
- Obstacle Collision Avoidance System (OCAS™)

Life testing

The Vestas Test Centre has the unique ability to test complete nacelles using technologies like Highly Accelerated Life Testing (HALT). This rigorous testing of new components ensures the reliability of the 3 MW platform.

Is the 3 MW platform the optimal choice for **your specific site?**

One common nacelle – five different rotor sizes
The wind conditions on a wind project site are often not identical. The 3 MW platform features a range of turbines that cover all wind classes and combined across your site they can maximise the energy output of your wind power plant.

Tip-height restrictions and strict grid requirements
With a rotor size of 105 m, the V105-3.45 MW™ IEC IA is the turbine that fits the most severe wind conditions. It has an extremely robust design for tough site conditions and is especially suited for markets with tip-height restrictions and high grid requirements.

Like all the other 3 MW turbines, the V105-3.45 MW™ is equipped with a full-scale converter ensuring full compliance with the challenging grid codes in countries like the UK and Ireland.

Cold climates
The V112-3.45 MW™, V117-3.45 MW™ , V126-3.45MW™ and V136-3.45 MW™ can be combined with Vestas De-Icing and Vestas Ice Detection ensuring optimum production in cold climates.

The Vestas De-Icing System is fully SCADA integrated and can be triggered automatically or manually depending on your de-icing strategy. Automatic control protects your investment, optimising the trigger point so the turbine only stops to de-ice when there is an expected net power production gain.

High- and medium-wind sites
The V112-3.45 MW™ IEC IA is a high-wind turbine and has a very high capacity factor. Similar to the other 3 MW turbines, the V112-3.45 MW™ IEC IA turbine makes efficient use of its grid compatibility and is an optimal choice for sites with MW constraints.

On medium wind-sites the V117-3.45 MW™ IEC IB/IEC IIA, V126-3.45 MW™ IEC IIA, V126-3.45 MW™ IEC IIB, and V136-3.45 MW™ IEC IIB/ IEC IIIA are excellent turbine choices. A combination of the variants can optimise your site layout and improve your production significantly on complex sites.

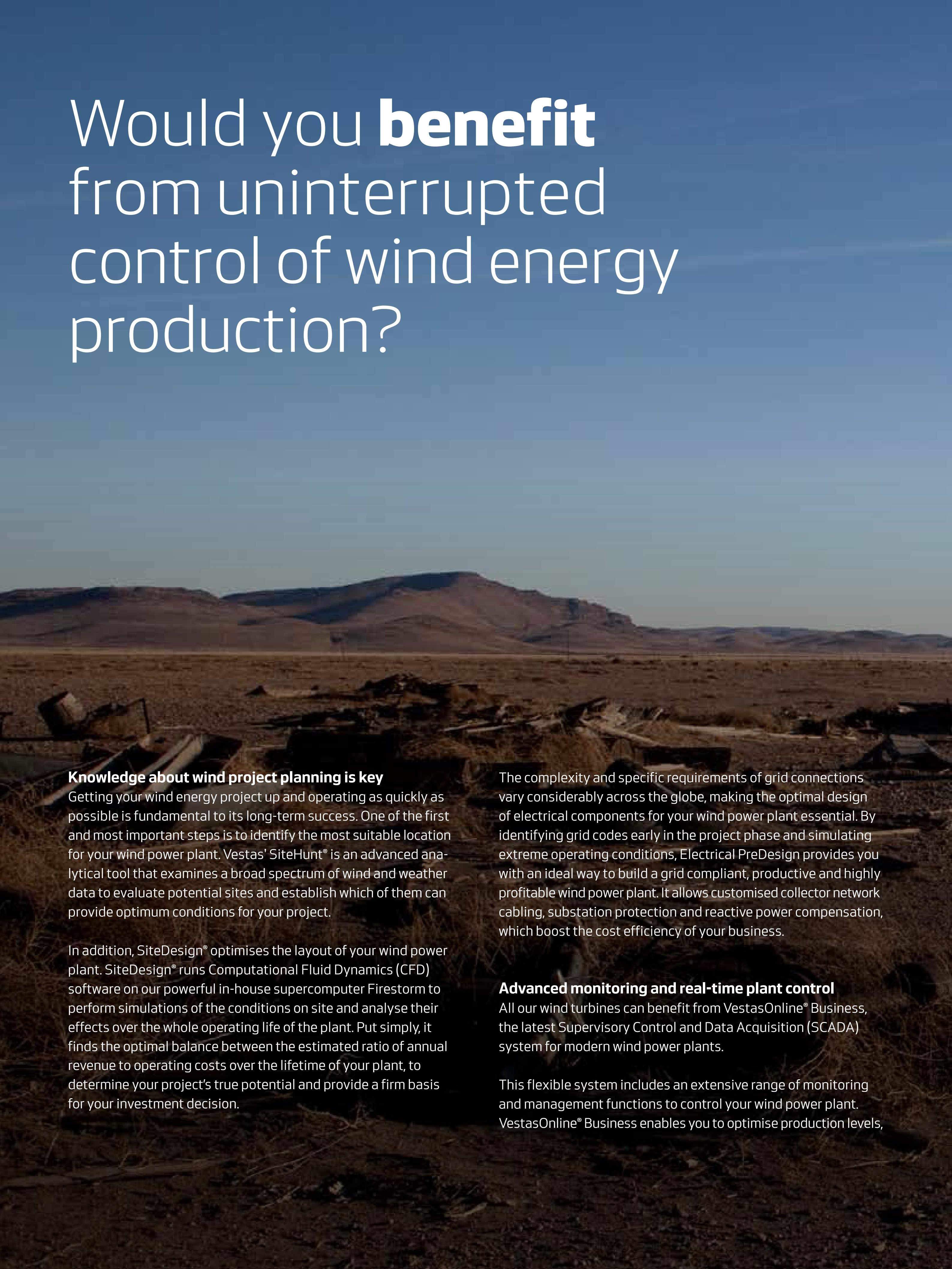
Low-wind sites
Built on the same proven technology as the V112-3.0 MW®, the V136-3.45 MW™ IEC IIB/ IEC IIIA is our best performer on low-wind sites. The larger rotor enable greater wind capture, which in turn produces more energy to reduce levelised cost of energy (LCOE). The result is exceptional profitability in areas with low wind, and new frontiers for wind energy investment.

Large Diameter Steel Towers (LDST) support the added rotor size and rating of Vestas turbines to increase Annual Energy Production on low-wind sites.

LDST is specially designed with a larger diameter in the bottom section that allows for optimal strength at high hub heights.

Maximising old permits
Although the V136-3.45 MW™ is one of the highest producing low wind turbine available, some old permits may simply be too tight to accept it. Although the V117-3.45 MW™ and V126-3.45 MW™ are medium-wind turbines, they still deliver an excellent business case on low-wind sites.

Due to the similar electrical properties and nacelle design, it is easy to mix and match the turbines from the 3 MW platform to maximise production on heavily constrained sites.



Would you **benefit** from uninterrupted control of wind energy production?

Knowledge about wind project planning is key
Getting your wind energy project up and operating as quickly as possible is fundamental to its long-term success. One of the first and most important steps is to identify the most suitable location for your wind power plant. Vestas' SiteHunt® is an advanced analytical tool that examines a broad spectrum of wind and weather data to evaluate potential sites and establish which of them can provide optimum conditions for your project.

In addition, SiteDesign® optimises the layout of your wind power plant. SiteDesign® runs Computational Fluid Dynamics (CFD) software on our powerful in-house supercomputer Firestorm to perform simulations of the conditions on site and analyse their effects over the whole operating life of the plant. Put simply, it finds the optimal balance between the estimated ratio of annual revenue to operating costs over the lifetime of your plant, to determine your project's true potential and provide a firm basis for your investment decision.

The complexity and specific requirements of grid connections vary considerably across the globe, making the optimal design of electrical components for your wind power plant essential. By identifying grid codes early in the project phase and simulating extreme operating conditions, Electrical PreDesign provides you with an ideal way to build a grid compliant, productive and highly profitable wind power plant. It allows customised collector network cabling, substation protection and reactive power compensation, which boost the cost efficiency of your business.

Advanced monitoring and real-time plant control
All our wind turbines can benefit from VestasOnline® Business, the latest Supervisory Control and Data Acquisition (SCADA) system for modern wind power plants.

This flexible system includes an extensive range of monitoring and management functions to control your wind power plant. VestasOnline® Business enables you to optimise production levels,

+33,000

The Vestas Performance and Diagnostics Centre monitors more than 33,000 turbines worldwide. We use this information to continually develop and improve our products and services.

monitor performance and produce detailed, tailored reports from anywhere in the world. The VestasOnline® Power Plant Controller offers scalability and fast, reliable real-time control and features customisable configuration, allowing you to implement any control concept needed to meet local grid requirements.

Surveillance, maintenance and service

Operating a large wind power plant calls for efficient management strategies to ensure uninterrupted power production and to control operational expenses. We offer 24/7 monitoring, performance reporting and predictive maintenance systems to improve turbine performance and availability. Predicting faults in advance is essential, helping to avoid costly emergency repairs and unscheduled interruptions to energy production.

Our Condition Monitoring System (CMS) assesses the status of the turbines by analysing vibration signals. For example, by measuring the vibration of the drive train, it can detect faults at an early stage and monitor any damage. This information allows pre-emptive maintenance to be carried out before the component fails, reducing repair costs and production loss.

Additionally, our Active Output Management® (AOM) concept provides detailed plans and long term agreements for service and maintenance, online monitoring, optimisation and troubleshooting. It is possible to get a full scope contract, combining your turbines' state-of-the-art technology with guaranteed time or energy-based availability performance targets, thereby creating a solid base for your power plant investment. The Active Output Management® agreement provides you with long term and financial operational peace of mind for your business case.

V105-3.45 MW™ IEC IA
Facts & figures

POWER REGULATION Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

(Noise modes dependent on site and country)

ROTOR

Rotor diameter	105 m
Swept area	8,659 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub height	72.5 m (IEC IA)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

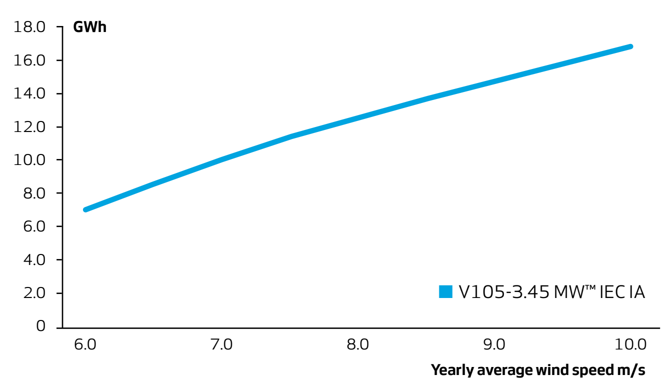
Length	51.2 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Low Temperature Operation to -30°C
- Fire Suppression
- Shadow Detection
- Increased Cut-In
- Nacelle Hatch for Air Inlet
- Aviation Lights
- Aviation Markings on the Blades
- Obstacle Collision Avoidance System (OCAS™)

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2, Standard air density = 1.225, wind speed at hub height

V112-3.45 MW™ IEC IA
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

(Noise modes dependent on site and country)

ROTOR

Rotor diameter	112 m
Swept area	9,852 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub height	69 m (IEC IA) and 94 m (IEC IA)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

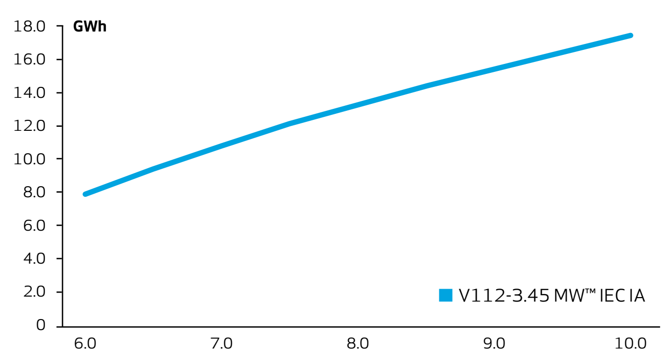
Length	54.7 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Nacelle Hatch for Air Inlet
- Aviation Lights
- Aviation Markings on the Blades
- Obstacle Collision Avoidance System (OCAS™)

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2,
Standard air density = 1.225, wind speed at hub height

V117-3.45 MW™ IEC IB/IEC IIA
Facts & figures

POWER REGULATION Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IB/IEC IIA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

(Noise modes dependent on site and country)

ROTOR

Rotor diameter	117 m
Swept area	10,751 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights	80 m (IEC IB), 91.5 m (IEC IB) and 116.5 m (IEC IB/IEC IIA/DIBtS)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

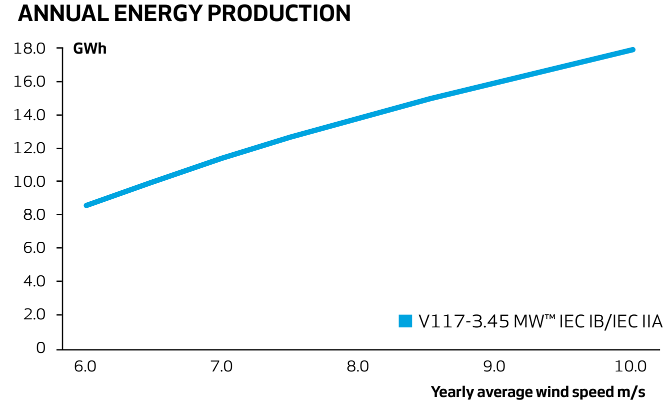
Length	57.2 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Nacelle Hatch for Air Inlet
- Aviation Lights
- Aviation Markings on the Blades
- Obstacle Collision Avoidance System (OCAS™)

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2,
Standard air density = 1.225, wind speed at hub height

V126-3.45 MW™ IEC IIB
Facts & figures

POWER REGULATION Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22.5 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIB

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER
(Noise modes dependent on site and country)

ROTOR

Rotor diameter	126 m
Swept area	12,469 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights	87 m (IEC IIB), 117 m (IEC IIB) and 137 m (IEC IIIA)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

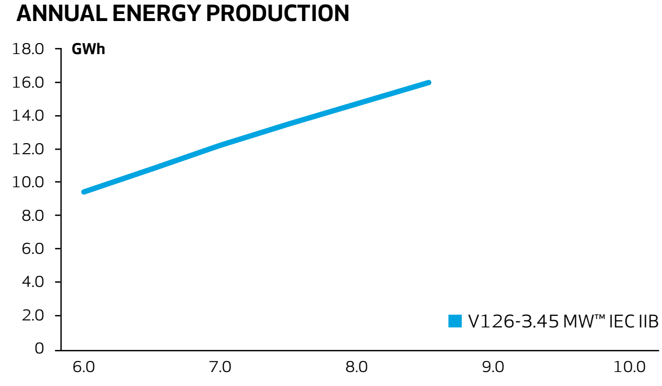
Length	61.7 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Nacelle Hatch for Air Inlet
- Aviation Lights
- Aviation Markings on the Blades
- Obstacle Collision Avoidance System (OCAS™)

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2,
Standard air density = 1.225, wind speed at hub height

V126-3.45 MW™ IEC IIA
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22.5 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

(Noise modes dependent on site and country)

ROTOR

Rotor diameter	126 m
Swept area	12,469 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights	87 m (IEC IIA), 117 m (IEC IIA/DIBtS), 137 m (IEC IIIA/DIBtS), 147 m (IEC IIIA), 149 m (DIBtS) and 166 m (DIBtS)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

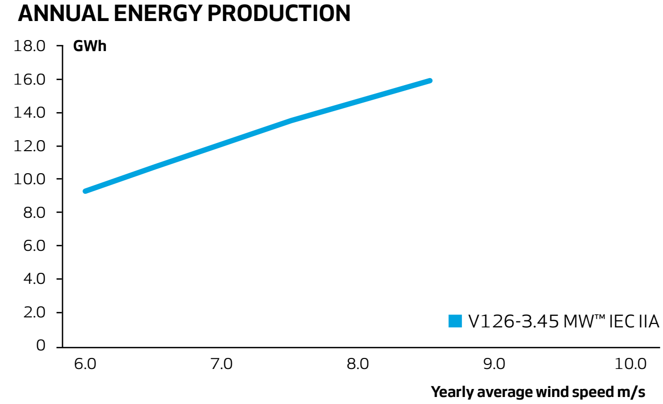
Length	61.7 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Nacelle Hatch for Air Inlet
- Aviation Lights
- Aviation Markings on the Blades
- Obstacle Collision Avoidance System (OCAS™)

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2,
Standard air density = 1.225, wind speed at hub height

V136-3.45 MW™ IEC IIB/IEC IIIA
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22.5 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIB/IEC IIIA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

(Noise modes dependent on site and country)

ROTOR

Rotor diameter	136 m
Swept area	14,527 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights 82 m (IEC IIB/IEC IIIA), 105 m (IEC IIIA), 112 m (IEC IIB/IEC IIIA), 132 m (IEC IIB/IEC IIIA/ DIBt2), 142 m (IEC IIIA), 149 m (DIBtS), and 166 m (DIBtS)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

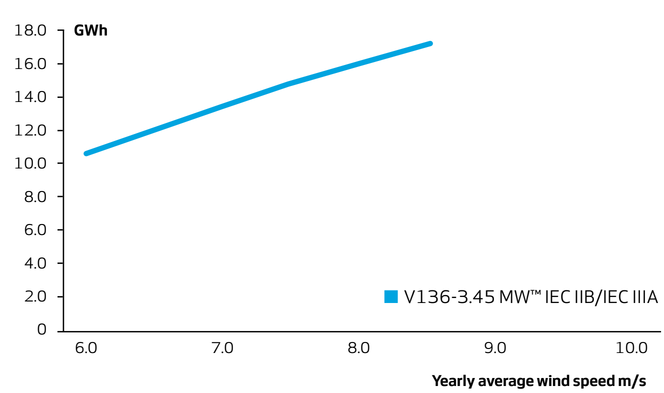
Length	66.7 m
Max. chord	4.1 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Nacelle Hatch for Air Inlet
- Aviation Lights
- Aviation Markings on the Blades
- Obstacle Collision Avoidance System (OCAS™)

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2,
Standard air density = 1.225, wind speed at hub height

Vestas Wind Systems A/S
Hedeager 42 . 8200 Aarhus N . Denmark
Tel: +45 9730 0000 . Fax: +45 9730 0001
vestas@vestas.com . **vestas.com**

10/2016-EN

Appendix B

Vehicle Turn Path Drawings

TWIN CREEK WIND FARM
ACCESS ROUTE TURN PATHS
60490763

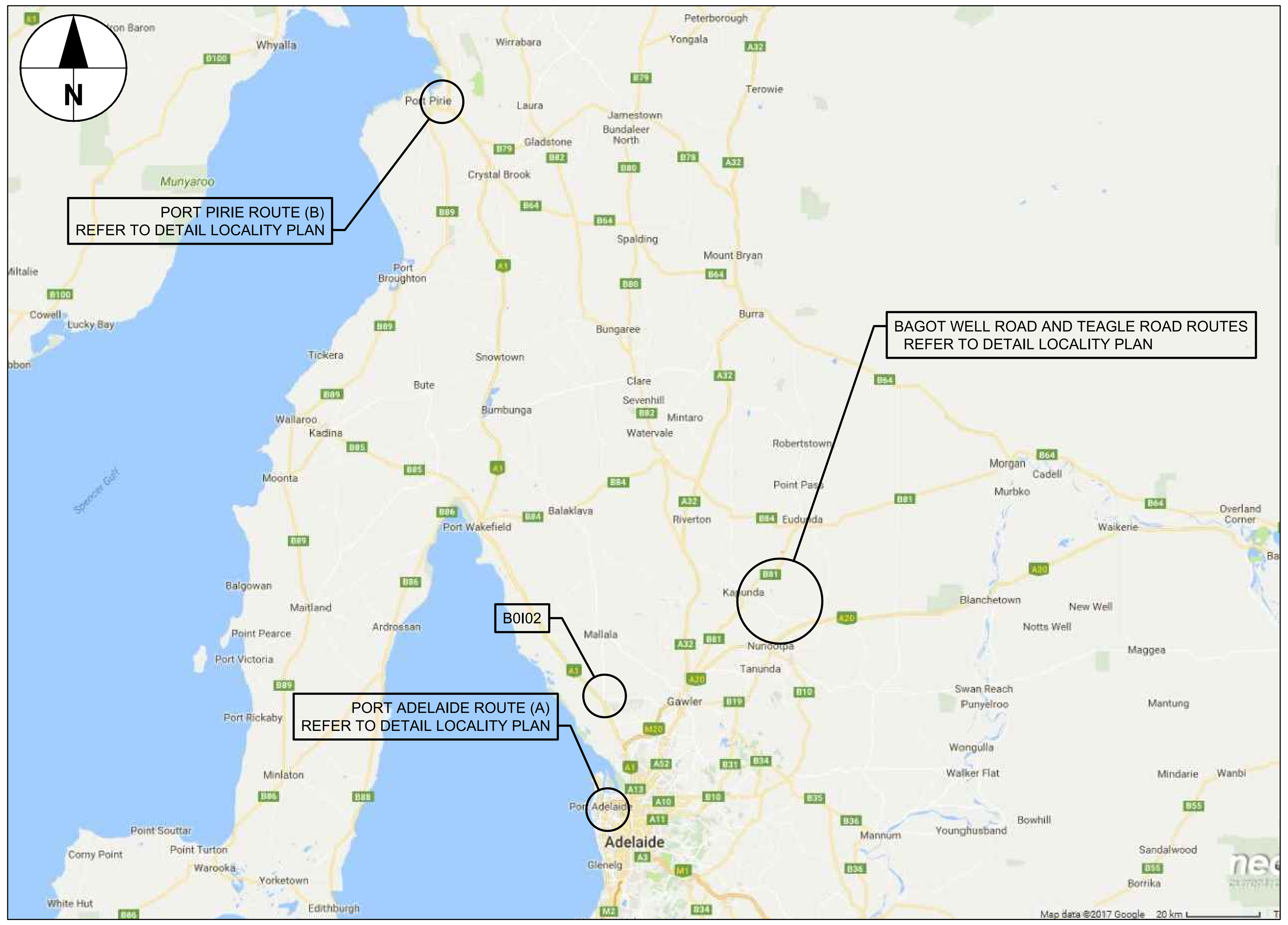
ROUTE
A - FROM PORT ADELAIDE
B - FROM PORT PIRIE

ROUTE SUB-NUMBER
0 - DEFAULT
1 - THROUGH BAGOT WELL ROAD
2 - THROUGH TEAGLE ROAD

TURN TYPE
I - INTERSECTION
C - BRIDGE CROSSING

XXXXX

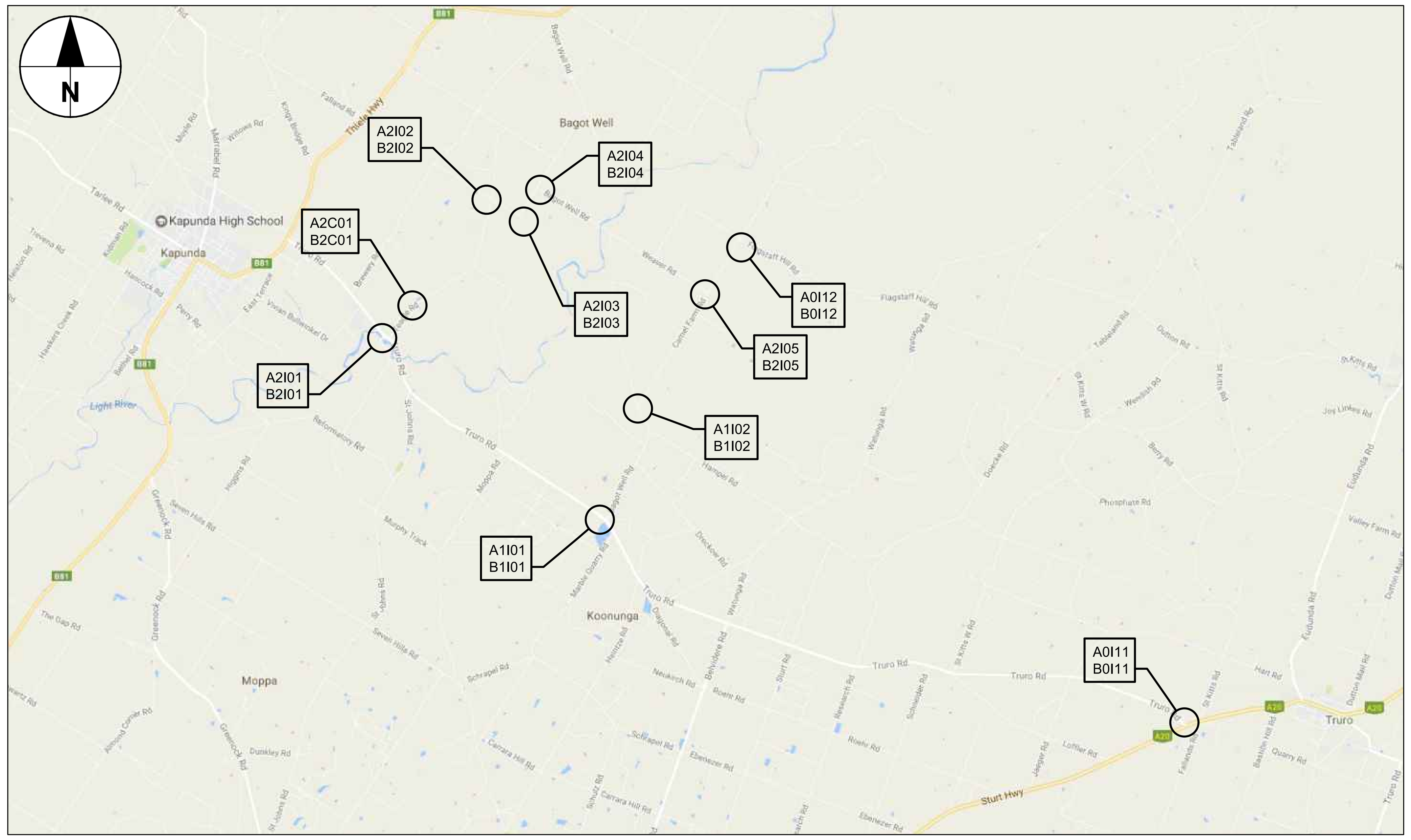
VEHICLE TURN CHECK AREA NUMBER BREAKDOWN

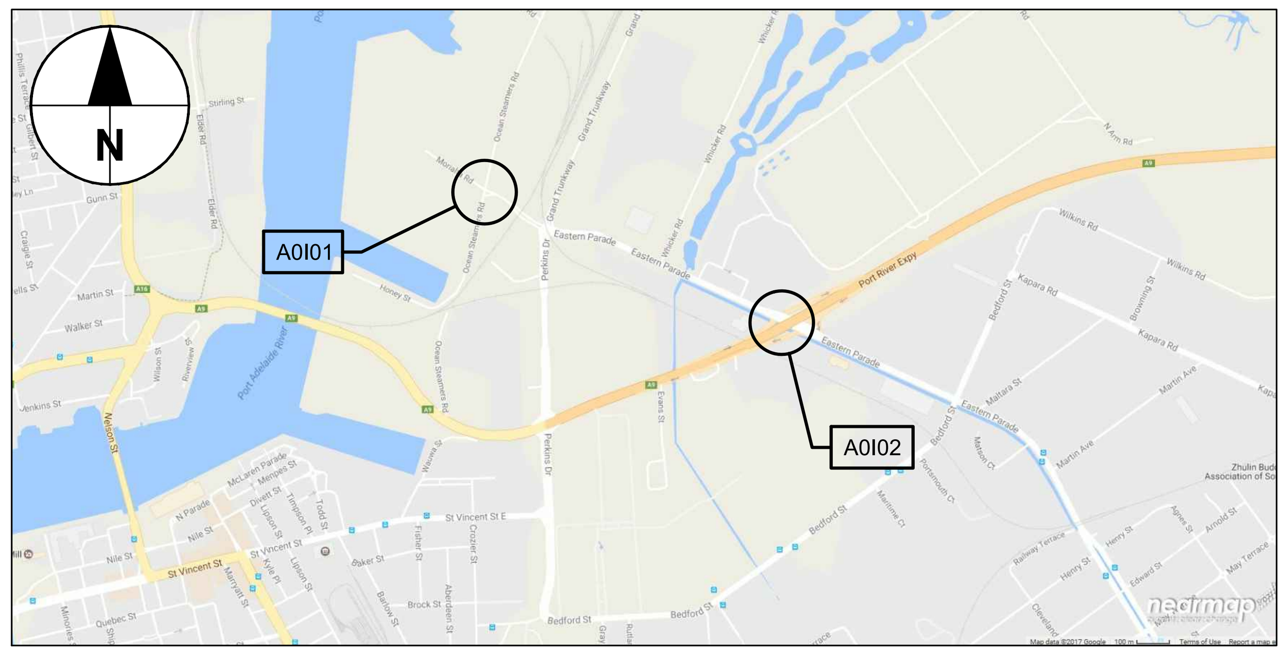


LOCALITY PLAN
SOUTH AUSTRALIA

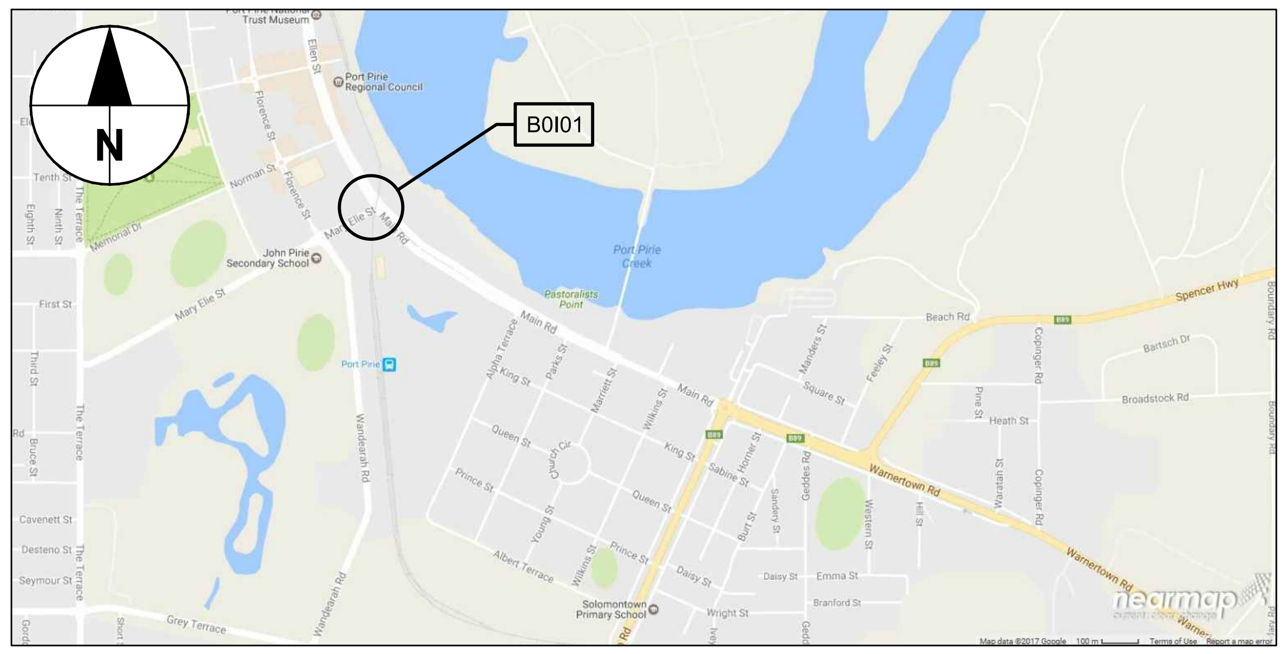
DRAWING LIST

60490763-SKE-C-0001	ACCESS ROUTE TURN PATHS	LOCALITY PLAN AND DRAWING INDEX
60490763-SKE-C-0101	ACCESS ROUTE TURN PATHS	INTERSECTION A0I01 (SOUTH)
60490763-SKE-C-0102	ACCESS ROUTE TURN PATHS	INTERSECTION A0I01 (NORTH)
60490763-SKE-C-0103	ACCESS ROUTE TURN PATHS	INTERSECTION A0I02
60490763-SKE-C-0201	ACCESS ROUTE TURN PATHS	INTERSECTION B0I01
60490763-SKE-C-0202	ACCESS ROUTE TURN PATHS	INTERSECTION B0I02
60490763-SKE-C-0301	ACCESS ROUTE TURN PATHS	INTERSECTION A0I11 / B0I11
60490763-SKE-C-0302	ACCESS ROUTE TURN PATHS	INTERSECTION A0I12 / B0I12
	ACCESS ROUTE TURN PATHS	
THROUGH BAGOT WELL ROAD		
60490763-SKE-C-1001	ACCESS ROUTE TURN PATHS	INTERSECTION A1I01 / B1I01
60490763-SKE-C-1002	ACCESS ROUTE TURN PATHS	INTERSECTION A1I02 / B1I02
THROUGH TEAGLE ROAD		
60490763-SKE-C-2001	ACCESS ROUTE TURN PATHS	INTERSECTION A2I01 / B2I01
60490763-SKE-C-2002	ACCESS ROUTE TURN PATHS	INTERSECTION A2I02 / B2I02
60490763-SKE-C-2003	ACCESS ROUTE TURN PATHS	INTERSECTION A2I03 / B2I03
60490763-SKE-C-2004	ACCESS ROUTE TURN PATHS	INTERSECTION A2I04 / B2I04
60490763-SKE-C-2005	ACCESS ROUTE TURN PATHS	INTERSECTION A2I05 / B2I05
	ACCESS ROUTE TURN PATHS	
60490763-SKE-C-2101	ACCESS ROUTE TURN PATHS	CROSSING A2C01 / B2C01





DETAIL LOCALITY PLAN
PORT ADELAIDE



DETAIL LOCALITY PLAN
PORT PIRIE

DETAIL LOCALITY PLAN
BAGOT WELL ROAD AND TEAGLE ROAD

AECOM

CONSULTANT
AECOM Australia Pty Ltd
A.B.N 20 093 846 925
www.aecom.com

PROJECT
TWIN CREEK WIND FARM

CLIENT
RES AUSTRALIA
SUITE 4 LEVEL 1, 760 PACIFIC HIGHWAY
CHATSWOOD, NSW 2067, AUSTRALIA

www.res-group.com
Prepared for: RES AUSTRALIA PTY LTD
A.B.N 55 106 637 754

PROJECT MANAGEMENT INITIALS

DESIGNER	CHECKED	APPROVED
SD		

PROJECT DATA

DATUM		SURVEY	

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2017.03.20	ISSUED FOR INFORMATION

PROJECT NUMBER
60490763

SHEET TITLE
TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
LOCALITY PLAN AND DRAWING INDEX

SHEET NUMBER
60490763-SKE-C-0001

ISO A1 594mm x 841mm

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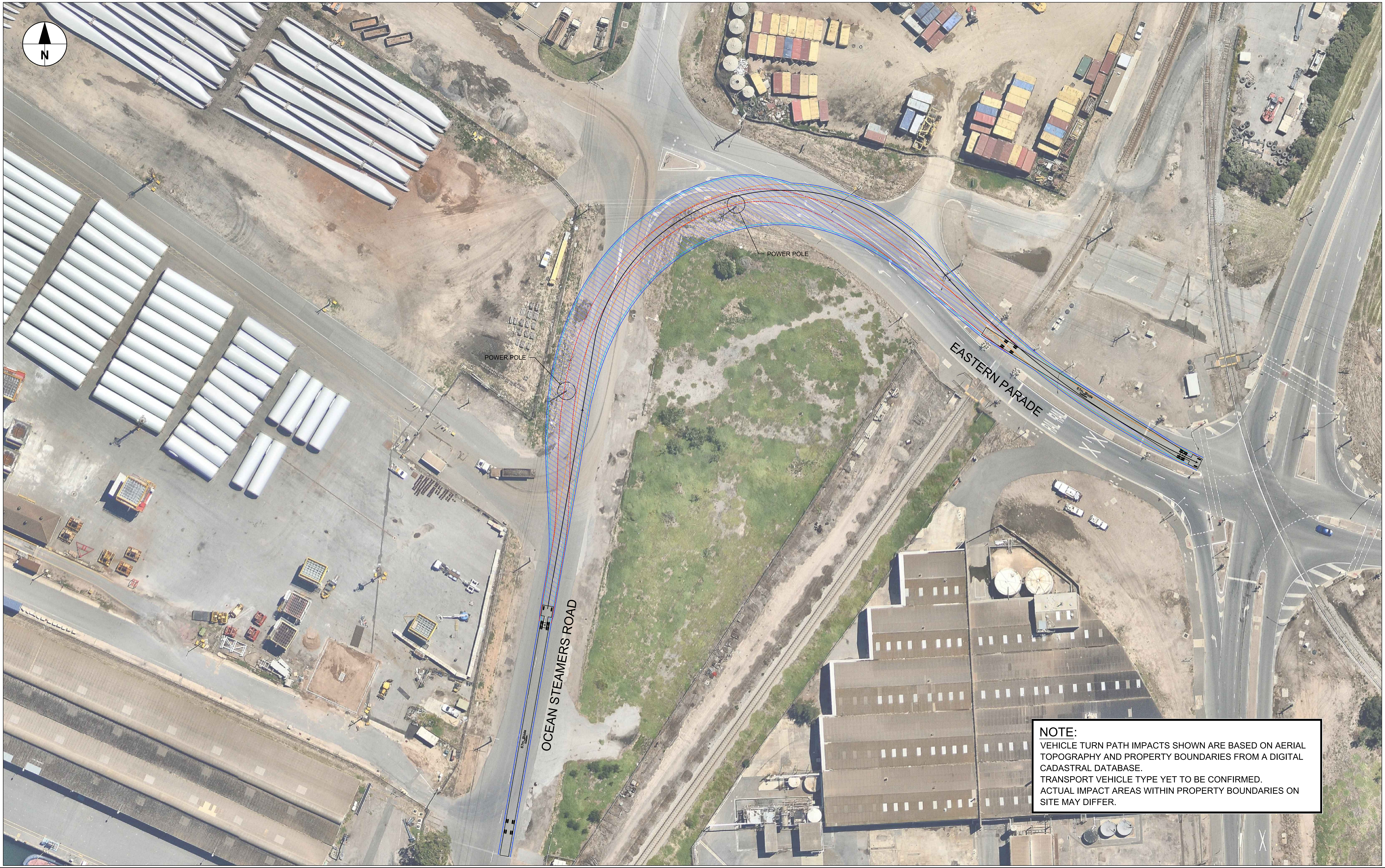
ISO A1 594mm x 841mm



NOTE:
VEHICLE TURN PATH IMPACTS SHOWN ARE BASED ON AERIAL TOPOGRAPHY AND PROPERTY BOUNDARIES FROM A DIGITAL CADASTRAL DATABASE.
TRANSPORT VEHICLE TYPE YET TO BE CONFIRMED.
ACTUAL IMPACT AREAS WITHIN PROPERTY BOUNDARIES ON SITE MAY DIFFER.

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PROJECT NUMBER
60490763

SHEET TITLE
TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A0I01 (SOUTH)

SHEET NUMBER
60490763-SKE-C-0101

ISO A1 594mm x 841mm

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TWIN CREEK WIND FARM

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DATUM	SURVEY

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A	2017.03.20	ISSUED FOR INFORMATION

PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A0I01 (NORTH)

SHEET NUMBER

60490763-SKE-C-0102

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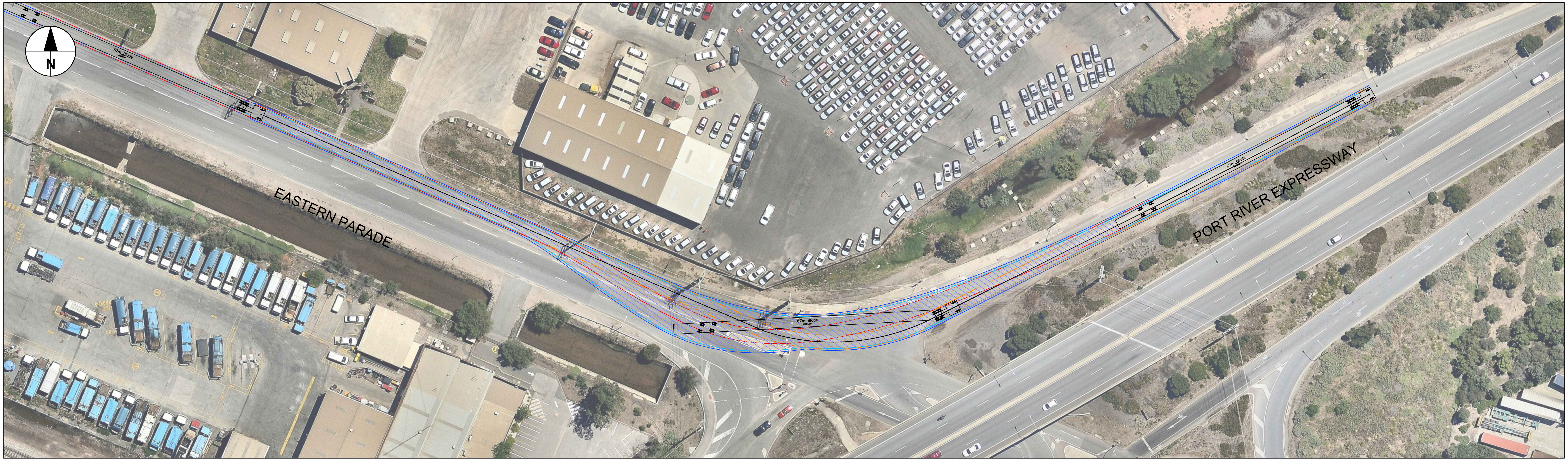

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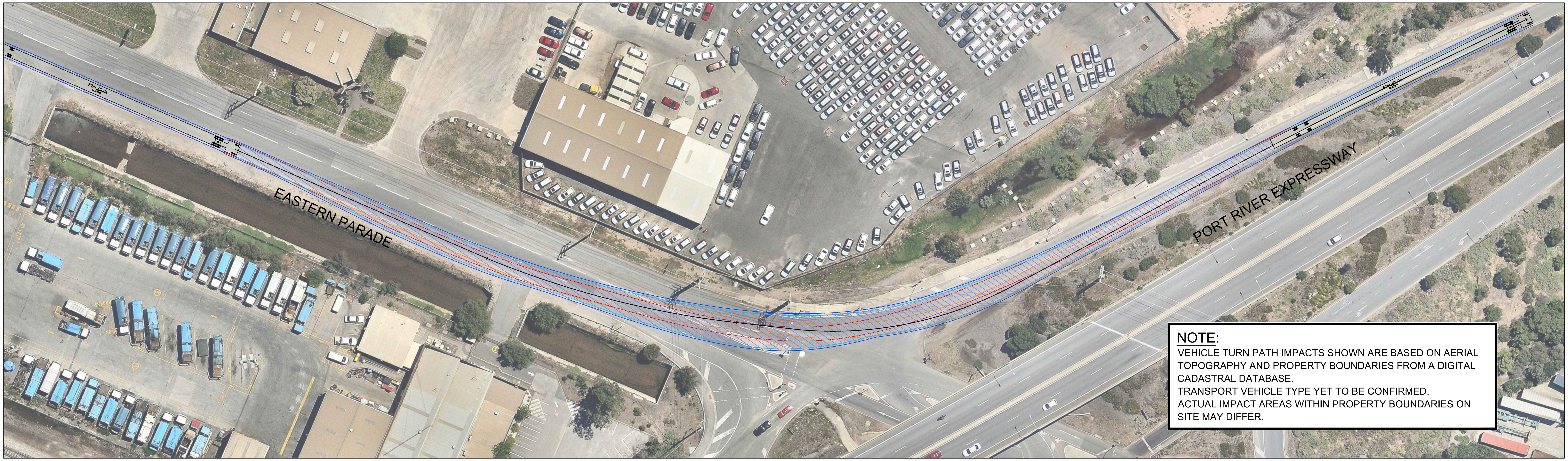

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PROJECT NUMBER

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SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A0I02

SHEET NUMBER

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PROJECT DATA

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ISSUE/REVISION

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PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION B0I01

SHEET NUMBER

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ISO A1 594mm x 841mm

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DESIGNER	CHECKED	APPROVED

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PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION B0I02

SHEET NUMBER

60490763-SKE-C-0202

NOTE:
VEHICLE TURN PATH IMPACTS SHOWN ARE BASED ON AERIAL TOPOGRAPHY AND PROPERTY BOUNDARIES FROM A DIGITAL CADASTRAL DATABASE.
TRANSPORT VEHICLE TYPE YET TO BE CONFIRMED.
ACTUAL IMPACT AREAS WITHIN PROPERTY BOUNDARIES ON SITE MAY DIFFER.

ISO A1 594mm x 841mm

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CHATSWOOD, NSW 2067, AUSTRALIA

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DATUM		SURVEY	

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ISSUE/REVISION

A	2017.03.20	ISSUED FOR INFORMATION
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A0I11 / B0I11

SHEET NUMBER

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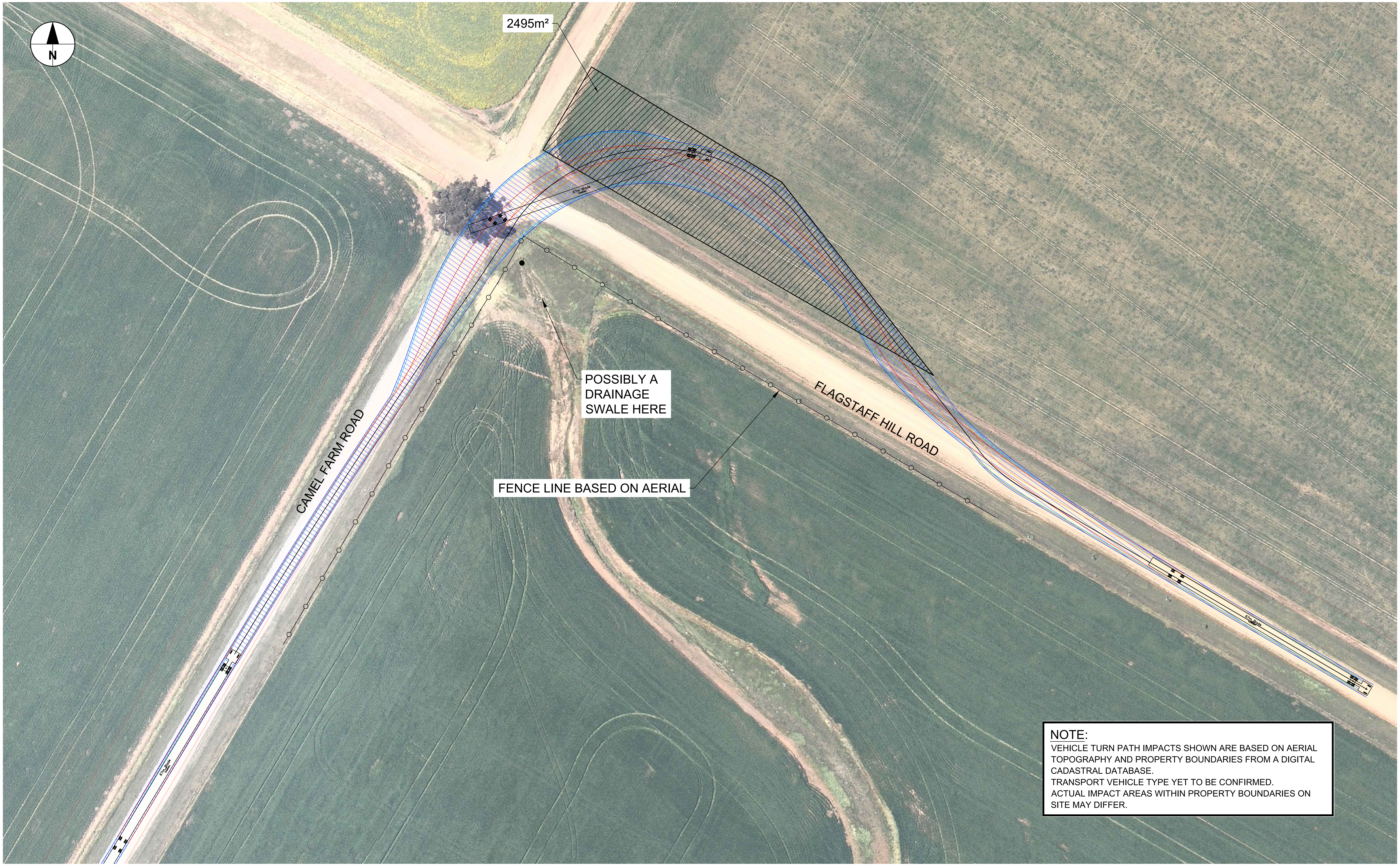

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TWIN CREEK WIND FARM

CLIENT

RES AUSTRALIA

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CHATSWOOD, NSW 2067, AUSTRALIA

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B	2017.06.26	ISSUED FOR INFORMATION
A	2017.03.20	ISSUED FOR INFORMATION
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A0I12 / B0I12

SHEET NUMBER

60490763-SKE-C-0302

ISO A1 594mm x 841mm

NOTE:
VEHICLE TURN PATH IMPACTS SHOWN ARE BASED ON AERIAL TOPOGRAPHY AND PROPERTY BOUNDARIES FROM A DIGITAL CADASTRAL DATABASE.
TRANSPORT VEHICLE TYPE YET TO BE CONFIRMED.
ACTUAL IMPACT AREAS WITHIN PROPERTY BOUNDARIES ON SITE MAY DIFFER.

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TWIN CREEK WIND FARM

CLIENT

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CHATSWOOD, NSW 2067, AUSTRALIA

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DATUM		SURVEY	

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2017.03.20	ISSUED FOR INFORMATION

PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A1I01 / B1I01

SHEET NUMBER

60490763-SKE-C-1001

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TRANSPORT VEHICLE TYPE YET TO BE CONFIRMED.
ACTUAL IMPACT AREAS WITHIN PROPERTY BOUNDARIES ON SITE MAY DIFFER.

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PROJECT
TWIN CREEK WIND FARM

CLIENT
RES AUSTRALIA
SUITE 4 LEVEL 1, 760 PACIFIC HIGHWAY
CHATSWOOD, NSW 2067, AUSTRALIA

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PROJECT MANAGEMENT INITIALS

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DESIGNER	CHECKED	APPROVED

PROJECT DATA

DATUM		SURVEY	

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ISSUE/REVISION

A	2017.03.20	ISSUED FOR INFORMATION
I/R	DATE	DESCRIPTION

PROJECT NUMBER
60490763

SHEET TITLE
TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A1I02 / B1I02

SHEET NUMBER
60490763-SKE-C-1002

ISO A1 594mm x 841mm

NOTE:
VEHICLE TURN PATH IMPACTS SHOWN ARE BASED ON AERIAL TOPOGRAPHY AND PROPERTY BOUNDARIES FROM A DIGITAL CADASTRAL DATABASE.
TRANSPORT VEHICLE TYPE YET TO BE CONFIRMED.
ACTUAL IMPACT AREAS WITHIN PROPERTY BOUNDARIES ON SITE MAY DIFFER.

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PROJECT
TWIN CREEK WIND FARM

CLIENT
RES AUSTRALIA
SUITE 4 LEVEL 1, 760 PACIFIC HIGHWAY
CHATSWOOD, NSW 2067, AUSTRALIA

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DESIGNER	CHECKED	APPROVED

PROJECT DATA

DATUM		SURVEY	

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
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PROJECT NUMBER
60490763

SHEET TITLE
TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A2I01 / B2I01

SHEET NUMBER
60490763-SKE-C-2001

NOTE:
VEHICLE TURN PATH IMPACTS SHOWN ARE BASED ON AERIAL TOPOGRAPHY AND PROPERTY BOUNDARIES FROM A DIGITAL CADASTRAL DATABASE.
TRANSPORT VEHICLE TYPE YET TO BE CONFIRMED.
ACTUAL IMPACT AREAS WITHIN PROPERTY BOUNDARIES ON SITE MAY DIFFER.

ISO A1 594mm x 841mm

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PROJECT

TWIN CREEK WIND FARM

CLIENT

RES AUSTRALIA
SUITE 4 LEVEL 1, 760 PACIFIC HIGHWAY
CHATSWOOD, NSW 2067, AUSTRALIA

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60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A2I02 / B2I02

SHEET NUMBER

60490763-SKE-C-2002

ISO A1 594mm x 841mm

NOTE:
VEHICLE TURN PATH IMPACTS SHOWN ARE BASED ON AERIAL TOPOGRAPHY AND PROPERTY BOUNDARIES FROM A DIGITAL CADASTRAL DATABASE.
TRANSPORT VEHICLE TYPE YET TO BE CONFIRMED.
ACTUAL IMPACT AREAS WITHIN PROPERTY BOUNDARIES ON SITE MAY DIFFER.

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CHATSWOOD, NSW 2067, AUSTRALIA

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DESIGNER	CHECKED	APPROVED
SD		

PROJECT DATA

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PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A2I03 / B2I03

SHEET NUMBER

60490763-SKE-C-2003

ISO A1 594mm x 841mm

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www.aecom.com

PROJECT
TWIN CREEK WIND FARM

CLIENT
RES AUSTRALIA
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CHATSWOOD, NSW 2067, AUSTRALIA

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PROJECT DATA

DATUM		SURVEY	

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PROJECT NUMBER
60490763

SHEET TITLE
TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A2I04 / B2I04

SHEET NUMBER
60490763-SKE-C-2004

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PROJECT

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CHATSWOOD, NSW 2067, AUSTRALIA

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PROJECT DATA

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PROJECT NUMBER

60490763

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TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
INTERSECTION A2I05 / B2I05

SHEET NUMBER

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CLIENT

RES AUSTRALIA
SUITE 4 LEVEL 1, 760 PACIFIC HIGHWAY
CHATSWOOD, NSW 2067, AUSTRALIA

www.res-group.com
Prepared for: RES AUSTRALIA PTY LTD
A.B.N 55 106 637 754

NOT FOR CONSTRUCTION

PROJECT MANAGEMENT INITIALS

SD		
DESIGNER	CHECKED	APPROVED

PROJECT DATA

DATUM		SURVEY	

0 12.5 25 m
1:500

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2017.03.20	ISSUED FOR INFORMATION

PROJECT NUMBER

60490763

SHEET TITLE

TWIN CREEK WINDFARM
ACCESS ROUTE TURN PATHS
CROSSING A2C01 / B2C01

SHEET NUMBER

60490763-SKE-C-2101